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Printed on Thin Paper for Foreign Circulation.

The Engineer.

Established 1856.

Registered as a Newspaper.

OFFICE FOR ADVERTISEMENTS & PUBLICATION, 33, NORFOLK ST., STRAND, LONDON, W.C. 2.

VOL. CXLI.—No. 3663] LONDON: FRIDAY EVENING, MARCH 12, 1926 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director - General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for :—

1. OIL ENGINE DRIVEN POWER PUMPING PLANT for Matheran Water Supply.
2. UNDERFRAMES and MISCELLANEOUS FITTINGS for RAILWAY CARRIAGES.
3. 98 UNDERFRAMES for RAILWAY CARRIAGES.

Tenders due 2 p.m., 24th March, 1926, for No. 1; 2 p.m., 7th April, 1926, for No. 2; 10.30 a.m., 26th April, 1926, for No. 3.
Tender forms obtainable from the above. 1839

G.I.P. RLY. ELECTRIFICATION.

The Director - General, India Store Department, Branch No. 15, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for :—

(1) 15 MOTOR COACH UNDERFRAMES and BODIES.
(2) 30 MOTOR BOGIE TRUCKS.

Tenders due on the 7th May, 1926, before 2 p.m.
Specification and form of Tender obtainable from the above at a fee of 5s. each, which will not be returned. 1840

Civil Engineer Required by the GOVERNMENT of the GOLD COAST for the PUBLIC WORKS DEPARTMENT for two tours of twelve to eighteen months' service, with possible extension. Salary £480 for the first three years of service, then £510, rising to £720 a year by annual increments of £30, and then rising to £920 by annual increments of £40. Outfit allowance £60 on first appointment. Free quarters and passages and liberal leave at home on full salary. Candidates, age between 25 and 35, must be fully qualified Civil Engineers, holding A.M.I.C.E. or equivalent professional qualifications and have had practical and general experience on the construction of roads, buildings, and other public works.—Apply at once in writing, stating age and giving brief details of experience and qualifications, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting clearly at head of application M/14,306. 1843

Indian State Railways.
DEPUTY TRANSPORTATION SUPERINTENDENT (TRACTION).
REQUIRED in September, 1926, for service in India with the Great Indian Peninsula Railway, a DEPUTY TRANSPORTATION SUPERINTENDENT to organise work of the Electric Traction Section of the Transportation Department and supervise generally the training of traction staff. Candidates must have had experience in electric traction, power generation, E.H.T. transmission, converting plant, overhead track equipment and the operation and maintenance of electric locomotives and multiple unit stock.
Commencing salary Rupees 1750 calendar monthly, rising by annual increments of Rupees 50 to Rupees 2000. Two years' agreement in first instance. First-class passage to India and home on satisfactory termination of service.
Candidates must be European British subjects and may be required to attend before a Selecting Authority in London at their own expense; also to pass a medical examination if selected for appointment.
The regulations in respect of the appointment and forms of application for use by candidates can be obtained on application to the SECRETARY, Public Works Department, India Office, Whitehall. Applications must reach the India Office not later than 31st March, 1926. 1778

The Government of India REQUIRE TWO ASSISTANT FOREMEN for the Shell Forge Section of the Metal and Steel Factory, Ishapore. (Appointments No. 26 and No. 68.)

QUALIFICATIONS :—

(a) Are between 25 and 30 years, general engineering apprenticeship, experience essential in the working of Hydraulic Presses, Pumps and Accumulators, &c., as used in the manufacture of Forgings for Shells, Base-plates, Diaphragms, and other ammunition components up to 6in. shell size.

(b) Candidates for Appointment No. 26 should have had, in addition to above, experience in the working of Drop Stamps and Trimming Presses.

(c) Candidates for Appointment No. 68 must have had, in addition to the qualifications called for at (A), experience in designing Jigs, Tools and Fixtures, Fitting, Erecting, and Turning, and a knowledge of General Machine Shop Practice.

Terms (in each case) five years' agreement in first instance.

Salary at the rate of Rs. 450-15-510 per calendar month, with prospects of further increases. Free quarters. Free passage to India and return passage on satisfactory termination of services. Medical examination.

Further particulars and forms of application may be obtained from the SECRETARY to the HIGH COMMISSIONER for INDIA, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 27th March, 1926. 1768

Indian Store Department.
Applicants for the Post of ASSISTANT ENGINEER INSPECTOR are informed that the VACANCY has now been filled. 1838 A

The South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—
SPARE PARTS of CARRIAGES and WAGONS.
Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.
Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Spare Parts of Carriages and Wagons," must be left with the undersigned not later than Twelve Noon on Friday, the 26th March, 1926.
The Directors do not bind themselves to accept the lowest or any Tender.
A charge, which will not be returned, will be made of 5s. for each copy of the specification.
Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster.

W. B. REYNOLDS,
For Managing Director.
91, Petty France, S.W. 1,
9th March, 1926. 1844

The Engineer

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PUBLIC NOTICES

ARMSTRONG COLLEGE,
NEWCASTLE-UPON-TYNE
(In the University of Durham).

Courses for the Pass Degree of B.Sc. (3 years) and the Honours Degree of B.Sc. (4 years) in Mechanical, Marine, Civil or Electrical Engineering, Mining, Metallurgy or Naval Architecture. Composition (tuition) fee: £40 per annum.

Other Courses for Pure Science, Arts, Commerce, Law, Agriculture and Fine Art.

Full particulars on application to:
REGISTRAR,
Armstrong College,
Newcastle-upon-Tyne.
1175

Crystal Palace School of Practical Engineering.
Founded 1872.
MECHANICAL AND CIVIL ENGINEERING DIVISIONS.
PRESIDENT: J. W. WILSON, M.I.C.E., M.I.M.E.
PRINCIPAL: MAURICE WILSON, M.I.C.E.
Assisted by Staff of Lecturers and Instructors.
Thorough, up-to-date Practical and Theoretical Instruction. Course completed in 2 years.
Students admitted at beginning of any term. 1174

Deeside District Committee.
(COUNTY OF ABERDEEN).
WANTED, ROAD SURVEYOR for the Deeside District Committee of the County of Aberdeen.
Particulars may be obtained from the Subscriber, who will receive applications, with testimonials, up to 31st March current.
JOHN MURRAY, Clerk,
Deeside District Committee.
22, Bridge-street, Aberdeen,
5th March, 1926. 1797

PUBLIC NOTICES

Liverpool Corporation Water-Works.
THIRD INSTALMENT—VYRNWY SUPPLY.
HIENANT-MOSDA SECTION.
CONTRACT NO. 1.
TO MANUFACTURERS OF CAST IRON AND STEEL WATER-PIPES.

The Water Committee of the Liverpool Corporation is prepared to receive TENDERS for the SUPPLY of about 4½ MILES of 42in. PIPES, together with a number of SPECIALS of the following alternative descriptions :—
(a) Cast Iron Pipes Lined with Cement Mortar.
(b) Steel Pipes Lined with Bitumen.
Alternative specifications and drawings have been prepared and may be inspected at the Water Engineer's Office, Alexandra Buildings, 55, Dale-street, Liverpool, on and after Monday, the 15th day of March, 1926. Copies of either of the specifications and forms of Tender may be obtained upon payment of a deposit of Five Guineas, which will be repayable upon receipt of a bona fide Tender and return of the documents and drawings issued.
Tenders, endorsed "Tender for Third Instalment Pipes," are to be sent through the post in a sealed envelope to the Town Clerk's Office, Municipal Buildings, Liverpool, addressed to the Chairman of the Water Committee, so as to be delivered not later than Twelve o'clock Noon on Monday, the 29th March, 1926.
The Water Committee do not bind themselves to accept the lowest or any Tender.
WALTER MOON,
Town Clerk.
Municipal Buildings, Liverpool,
13th March, 1926. 1848

City and Royal Burgh of Dundee.
ELECTRICITY DEPT.
PLANT FOR SALE.

FOR SALE, TWO 2000 K.W. Willans-Parsons STEAM TURBINES, coupled to Dick-Kerr 3-Phase ALTERNATORS, complete with Condensers and Edwards' Air Pumps. Normal full load 2000 K.W. at 1500 r.p.m. Will carry overloads of 3500 K.W. without opening the overload valve, or 3000 K.W. with overload valve opened.
DESIGNED STEAM CONDITIONS.—Pressure 175 lb. per sq. in. at stop valve. Superheat 150 deg. F. Vacuum 28½in. mercury.
ALTERNATOR NORMAL RATINGS.—2500 K.V.A. at .8 power factor, 3-phase, 6000/6600 v., 50 cycles. Temperature rise 35 deg. C.
CONDENSING PLANT.—The Condensers have each a total surface of 3550 sq. ft. Air Pumps, Edwards' 3-throw, driven by 200 v. D.C. Motors.
The above plant, which is dismantled and can be seen at any time, will be sold either as a complete unit or separately, and offers for the whole or any of the plant should be sent to the undersigned.
D. H. BISHOP, B.Sc., M.I.E.E.,
General Manager.
Electricity Supply Department,
Dudhope Crescent-road, Dundee,
Monday, 8th March, 1926. 1819

PUBLIC NOTICES

Kettering Urban District Council.
BUILDINGS—NORTHFIELD DEPOT.

The above Council invite TENDERS for the SUPPLY and ERECTION of STEEL TRUSSES, STANCHIONS, &c., in connection with the Construction of Buildings at their Northfield Depot, Kettering.
Specification and bill of quantities, together with form of Tender, may be had on application to Mr. T. Reader Smith, Engineer and Surveyor, Market-place, Kettering.
Tenders, endorsed "Northfield Depot," must be received by me not later than first post on Tuesday, the 23rd instant.
The Council do not bind themselves to accept the lowest or any Tender.
JOHN BOND,
Clerk to the Council.
Council Offices, Kettering,
9th March, 1926. 1826

West Kent Main Sewerage Board.
SALE OF PLANT BY TENDER.

OFFERS are INVITED for the PURCHASE of all or any of the following PLANT :—
Two Steam Locomotives, by "Kerr-Stuart," 24in. gauge.
Two "Simplex" Petrol Locomotives, 20in. gauge.
"Ruston" Steam Crane Navvy, fitted with 1 cub. yd. bucket.
"Butters" Scotch Steam Derrick Crane, 75ft. jib, lifting capacity 3 tons.
Two "Priestman" Grabs.
"Smith" 3-Ton Steam Locomotive Crane.
Vertical Steam Boiler, complete with injector.
Two No. 5 Pulsometer Steam Pumps.
Twenty-four cub. yd. Side-tip Wagons, 24in. gauge.
"Hecla" Disc Crusher, Size 18, together with Screen, Shafting, Pulleys, Timber Framing, &c.
"Smith" and "Pitt" Concrete Mixer with "Gardner" Petrol Engine, ¼ cub. yd. capacity.
"Ransomes" Concrete Mixer, with "Lister" Petrol Engine, ¼ cub. yd. capacity.
The lots may be seen at the Board's Sewage Purification Works, Long Reach, Dartford, Kent, between the hours of 9 a.m. and 5 p.m.
Forms of Tender and conditions of sale may be obtained at the Board's Offices, Park House, Beckenham-lane, Bromley, Kent.
Tenders must be delivered to the undersigned not later than Twelve Noon on Monday, the 22nd day of March, 1926.
The Board reserve to themselves the right to accept the highest or any Tender.
ARTHUR B. COOMBER,
Secretary of the Board.
1816

Liverpool Corporation Water-Works.
TEMPORARY DRAUGHTSMEN REQUIRED.

APPLICATIONS are INVITED for the following TEMPORARY POSITIONS :—
1. SENIOR DRAUGHTSMAN. Salary at rate of £350 per annum.
2. DRAUGHTSMAN. Salary at rate of £270 per annum.
3. JUNIOR DRAUGHTSMAN. Salary according to age scale; maximum £200 at 27.
Applicants for positions 1 and 2 must have had good experience in design of Waterworks (Gravitation).
Applications, which must be accompanied by full particulars of experience and qualifications and copies of three recent testimonials, to be addressed to the WATER ENGINEER, 55, Dale-street, Liverpool, to be received not later than Wednesday, the 31st March, 1926. 1847

Metropolitan Borough of Hackney.
BOROUGH ENGINEER AND SURVEYOR'S DEPARTMENT.
APPOINTMENT OF ENGINEERING ASSISTANT AND DRAUGHTSMAN.

The Borough Council are prepared to receive APPLICATIONS for the above-named APPOINTMENT, which, under the Council's scale, is a Class I. position at a salary of £375 per annum, rising by annual increments of £15 to £450 per annum. This salary is subject to a percentage reduction of 1.389 for every five points' fall below 100 in the official Index figure of the cost of living. Present actual commencing salary £354 5s. per annum. All salaries are subject to a percentage deduction in accordance with the provisions of the Council's Superannuation Act, 1908.
Candidates should be expert surveyors, levellers, and draughtsmen, and should have had good experience in the carrying out of works of sewerage and drainage, street paving and improvements, building construction, and municipal engineering work generally. Preference will be given to candidates who have passed the Associate Membership Examination of the Institution of Civil Engineers or hold the Testamur of the Institution of Municipal and County Engineers or equal diploma.
The appointment will be held during the pleasure of the Council subject to one month's notice on either side.
The successful candidate will be required to pass satisfactorily a medical examination within 14 days of appointment and before entering upon his duties.
Applications must be made on printed forms to be obtained from the undersigned on receipt of a stamped addressed (foolscap) envelope, which must be returned on or before Monday, the 22nd March, 1926.
E. H. R. TEE,
Town Clerk.
Town Hall, Hackney, E. 8,
5th March, 1926. 1796

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PUBLIC NOTICES

Sudan Government Railways

REQUIRE the SERVICES of a DISTRICT TRAFFIC MANAGER. Age 25 to 32, preferably single. Candidates should have had public school education and training on a British railway with good general experience of the operation of the Traffic Department. Starting rate of pay £480 to £540 per annum, according to age and qualifications. Progressive and pensionable post if satisfactory. Strict medical examination. Free first-class passage. Liberal leave with assisted passages.—Apply by letter to ADVISORY ENGINEER, Sudan Government London Office, Wellington House, Buckingham-gate, S.W. 1, marking envelope "District Traffic Manager." 1804

Sudan Government Railways

REQUIRE the SERVICES of a DISTRICT LOCOMOTIVE SUPERINTENDENT. Age 26 to 32, preferably single. Candidates should have been trained on a British railway or in a locomotive builder's works, and should have good knowledge of the working of a locomotive department. A.M.I.C.E. degree or equivalent desirable. Commencing salary £480 to £540 per annum, according to age and qualifications (£1 equals £1 0s. 6d.). Progressive and pensionable post if satisfactory. Strict medical examination. Free first-class passage. Liberal leave with assisted passages.—Apply by letter to ADVISORY ENGINEER, Sudan Government London Office, Wellington House, Buckingham-gate, S.W. 1, marking envelope "Dist. Loco. Supt." 1806

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, ASSISTANT CIVIL and MECHANICAL ENGINEERS. Applicants must have had extensive experience of the design and construction of large Engineering Works. They must have served a regular pupilage or apprenticeship, which must have included drawing-office experience, and in the case of Mechanical Engineers a thorough workshop training. Preference will be given to applicants who possess a University Degree or equivalent qualification.

Applications should be addressed 1767, The Engineer Office, and should state full particulars of education, technical training, experience, war service, and salary required. 1767 A

WANTED, ESTIMATORS in Civil, Structural and Mechanical Engineering Work. Applicants must have had extensive experience in similar work. They must have served a regular pupilage or apprenticeship, which must have included drawing-office experience and, in the case of Estimators for Mechanical Engineering, a thorough workshop training. Preference will be given to applicants who possess a University Degree or equivalent qualification.

Applications should be addressed 1768, The Engineer Office, and should state full particulars of education, technical training, experience, war service, and salary required. 1768 A

APPLICATIONS are INVITED for DEPUTY to ASSISTANT WORKS MANAGER in London district, with prospects of promotion to Assistant Works Manager within a few years. Must be a good all-round qualified Mechanical Engineer, about 30 years of age. Board of Trade Certificate. Good workshop experience, able to handle modern workmen, organiser and experienced in Oil Engines. Until attaining senior position, which is pensionable, the base rate remuneration will be £4 7s. 6d. per week plus Civil Service bonus, equivalent at present time to about £6 14s. per week. Copies of testimonials only.—Address, 1824, The Engineer Office. 1824 A

ENGINEER REQUIRED, Experienced in the Preparation and following up of Tenders involving technical knowledge of Turbines, Condensing Plant, Pumps, &c.—Replies, giving full details of qualifications, experience, and salary required, to be addressed to W. H. ALLEN SONS and CO., Ltd., Bedford. 1816 A

SITUATIONS OPEN (continued)

CRANES, EXCAVATORS, CRUSHERS.—A Westminster FIRM, holding valuable agencies for British and American Manufacturers of the above, and about to organise separate departments, REQUIRE a REPRESENTATIVE for each on a commission basis, who has the necessary experience and connection for big business.—Write, "MACHINERY," Box 607, Dorland's, 14, Regent-street, S.W. 1. P1672 A

ENGINEER REQUIRED, Thoroughly Experienced in all Road Surfacing Work, including mastic carpet and tar-macadam. Experience must cover all phases of the work, as well as estimating, costing and organising. Good prospects of advancement to progressive man.—Apply by letter only, giving full particulars of experience, which will be treated in confidence, employers, training, age, and salary required, to L. J. SPEIGHT, Ltd., Sardinia House, Sardinia-street, Kingsway, W.C. 2. 1825 A

EXPERIENCED VALUER of PLANT and MACHINERY, &c., REQUIRED, with knowledge of lotting-up works for Auction Sales.—Write, stating age, experience, and salary required, to Box 279, c/o Taylor's, Devon House, Gt. Portland-street, W. 1. 1831 A

FIRM REQUIRED to ACT as REPRESENTATIVES in Lancashire and Cheshire, on a commission basis, for an old-established firm of Reinforced Concrete Engineers. Must have live connection amongst architects and municipal authorities.—Address, giving full particulars, 1856, The Engineer Office. 1856 A

REQUIRED for Phosphate Works in Central Pacific, (a) 2 SHIFT ENGINEERS with good power-house experience, accustomed to 2 and 4-cycle Diesel Engines and 3-phase Generators; and (b) 1 ELECTRICIAN with all-round experience, especially Winding of A.C. Motor Armatures.

Wages in each case £18 per month, with free quarters, rations, and medical attendance. Four years' agreement, passage paid out and home. Single men preferred, age 26 to 35. Only those thoroughly competent should apply with fullest particulars.

Address, P1671, The Engineer Office. P1671 A

REQUIRED by a Well-known and Long-established London General Engineering Works (one-man company), a GENERAL MANAGER, age about 40, of considerable skill and knowledge. Salary at the rate of five hundred per ann. (unconditionally); future emoluments depends on merit. No one entertained who has not had considerable experience in general engineering such as the London area requires and not held too many situations to gain his experience. Air Compressing, Power Transmission, Millwrights and Machinists, Lifting Appliances, Pumping, &c. &c. All communications treated as strictly private by aged and experienced owner. Only suitable applicants will be answered. Do not send original testimonials.—Address, P1687, The Engineer Office. P1687 A

SENIOR ASSISTANT ESTIMATOR REQUIRED, with thorough knowledge of Railway Carriage Work. State age, full particulars of experience, and salary required to GENERAL MANAGER, The Midland Railway Carriage and Wagon Co., Ltd., Washwood Heath, Birmingham. 1815 A

WANTED by Firm Manufacturing Lap-welded Tubes, 18in. up, LEADING ESTIMATING DRAUGHTSMAN, with thorough knowledge of Pipe Design for hydro-electric schemes. State experience and salary required.—Address, 1811, The Engineer Office. 1811 A

WANTED, First-class ENGINEERING DRAUGHTSMAN; experience in the requirements for modern Steam Plants desirable.—Address, stating experience, age, and salary required, P1674, The Engineer Office. P1674 A

SITUATIONS OPEN (continued)

WANTED, JUNIOR DRAUGHTSMAN, Preferably with experience in Cement Works Plant.—Apply, giving particulars of experience and salary required, to MAXTED and KNOTT, Ltd., Dunstable. 1770 A

DESIGNER REQUIRED. Must Have Had Experience with intricate machinery. Permanent position for suitable man. In reply state what original work you have done, age, and salary required.—Address, 1853, The Engineer Office. 1853 A

DETAIL DRAUGHTSMAN REQUIRED for Power Station Work. Experience on Water-tube Boiler, Pipe Work or Steel Structures an advantage. State age, experience, and salary required.—Address, 1812, The Engineer Office. 1812 A

DRAUGHTSMEN.—BEFORE NEGOTIATING with Government Departments in connection with any post, PLEASE COMMUNICATE with the GENERAL SECRETARY, Association of Engineering and Shipbuilding Draughtsmen, 96, St. George's-square, London, S.W. 1. 1169 A

DRAUGHTSMAN for London Office; Capable in design of Sewers and similar works. State experience, age, salary.—Box 995, c/o Judd's, 87, Gresham-street, E.C. 1833 A

DRAUGHTSMAN, Good, Quick, Accurate, REQUIRED for Aircraft Experimental Design. Aircraft experience essential.—Write, stating age, salary required, experience, when free, &c., to WESTLAND AIRCRAFT WORKS, Yeovil. 1851 A

DRAUGHTSMAN, Mechanical, WANTED for S.E. London district; preferably one used to large Instrument Work and Modern Shops Production. Basic rate 50s., rising to 60s. weekly, plus Civil Service bonus; total approximately on minimum rate 83s. 6d. An ex-soldier if fully qualified will be preferred.—Box 223, c/o Pool's Advertising Service, 180, Fleet-street, London. 1852 A

DRAUGHTSMAN REQUIRED, Accustomed to Crane Work. Good salary and permanent situation for suitable man. Age about 30.—Address, 1850, The Engineer Office. 1850 A

DRAUGHTSMAN REQUIRED for the Birmingham district. Thoroughly experienced in the design of Machine Tools, Jigs, and Press Tools. Full particulars of experience, also age and wages required.—Address, P1683, The Engineer Office. P1683 A

DRAUGHTSMAN, with All-round Experience of the design and construction of Electrical Generators and Motors, REQUIRED by old-established firm. State full particulars of experience and salary required.—Address, 1698, The Engineer Office. 1698 A

DRAUGHTSMAN, with Experience in Machine and Tool Designing on accurate repetition work. Excellent opportunities for capable young man to make good position. Must be quick and accurate. State age, experience, and wages required.—Address, 1854, The Engineer Office. 1854 A

STRUCTURAL DRAUGHTSMAN WANTED, to Prepare Shop Details of Steel Work. One who has had experience in the office of a steel work contractor preferred.—Address, stating age and salary expected, giving an outline of previous experience, 1855, The Engineer Office. 1855 A

PATTERN SHOP FOREMAN REQUIRED, Capable of efficiently managing large modern shop. Good organiser with experience in Steam and Oil Engines, Turbines, Condensing Plant and Mill Gearing Work.—Apply, stating age, experience, and wages required, to HICK, HARGREAVES and CO., Ltd., Soho Ironworks, Bolton. 1810 A

SITUATIONS WANTED

AMBITIOUS MAN (36) SEEKS POSITION; Office and works experience, general eng., carr., wagon and loco.; would make good assist. to works manager. Low salary until abilities proved. Who'll give me an opening?—Address, P1692, The Engineer Office. P1692 B

CONSULTING ENGINEERS AND FIRMS WITH CONTRACTS ABROAD.

CONSTRUCTIONAL ENGINEER (38), A.M.I. Mech. E., A.M.I.E.E., A.I.E.E., with wide factory and power station experience, DESIRES responsible POSITION abroad; used to tropical climates and handling of native labour.

Address, P1675, The Engineer Office. P1675 B

ENGINEER, Ex-Manager, Ex-Sub. Director, Large firms abroad, ship repairs, dry dock, lighter construction, slipway, &c., practical and technical knowledge all branches trade, harbour experience for marine survey, fluent Spanish, knowledge Portuguese and Italian, B.O.T. Certificate, splendid foreign references, understanding commercial life South American Republics, especially Argentine, DESIRES POSITION, home or abroad, as Representative or Assistant Director of Works.—Apply, PERCY J. BARTHOLOMEW, 33, Queen's-road, Portsmouth. P1682 B

ENGINEER, Mechanical and Electrical, SEEKS POSITION. Now finishing five years' agreement. Good organiser, capable controller, keen and full of initiative, capable estimator and surveyor. An intensive worker with an exceptional experience. Sound practical and theoretical knowledge of the manufacture and maintenance of steam, gas, oil and Diesel engines, boilers, pumps, compressors, hydraulics, electric power generation, various classes of machinery, water well plant and road motors (steam and petrol).—Address, P1676, The Engineer Office. P1676 B

ENGINEER (33) SEEKS Responsible POSITION; used to control of staff, planning, tools, organising, &c.; shop experience, energetic, light engineering.—Address, P1663, The Engineer Office. P1663 B

ENGINEERING STORES SUPT. or ASSISTANT. First-class experience in tools of every description, Eng. and Amer., for every trade; 25 years' experience, solely in the tool trade; accustomed to buying; typist.—Address, P1678, The Engineer Office. P1678 B

ENGINEER (36), Technical and Practical, DESIRES POSITION; 13 years' experience design, erection, maintenance chemical process plant, including power plant, heating, cooling, evaporating, solvent gas recovery, distillation, &c.—Address, P1689, The Engineer Office. P1689 B

G. I. MECH. E. (23) DESIRES POST, Home or abroad. Secondary and tech. educ.; over 4 years loco. shops, 14 mths. D.O., 6 mths. running shed, 6 mths. admin. and commer. exp.—Address, P1694, The Engineer Office. P1694 B

INCREASED BUSINESS DOES NOT COME WITHOUT ORGANISED EFFORT.—An AMBASSADOR of COMMERCE, M.I. Mech. E., A.M.I.C.E., with exceptional experience, offers his Personality and Proved Ability, Administrative or Representative Capacity where co-ordination of manufacturing and sales effort is required at home or abroad.—Address, P1651, The Engineer Office. P1651 B

For continuation of Small Advertisements see page 3.

WANTED.

A well-known Firm of Engineers on the lists of the Admiralty, War Office, India Office, Crown Agents for the Colonies, Indian State Railways, etc.—with Modern Works well equipped with up-to-date machinery—WISH to UNDERTAKE the MANUFACTURE of one or two PROPRIETARY ARTICLES, and, if required, are PREPARED to HANDLE the SELLING of SAME. Their Sales Department is well organised—Six Branches in Great Britain—and they have a Good Connection with Consulting Engineers, Architects, Steel Works, Shipbuilders, Railways, Export Merchants, etc., and are PREPARED to TAKE UP one or two SELLING AGENCIES for firms of approved standing whose manufactures DO NOT COMPETE WITH THE GOODS DETAILED BELOW:—

ELECTRIC:

CRANES OF ALL TYPES - -

PASSENGER AND GOODS LIFTS, CAPSTANS, WINCHES and BLOCKS.

HYDRAULIC:

LIFTING, SHIP, BOILER FLUE AND PULLING JACKS. PRESSURE PUMP3 AND BOILER PROVERS. RAIL, SHAFT AND GIRDER BENDERS AND STRAIGHTENERS. WHEEL PRESSES.

WESTON'S SPUR AND WORM GEAR PULLEY BLOCKS, WIRE AND HEMP ROPE BLOCKS, SELF-LUBRICATING GARGO BLOCKS, SCREW LIFTING AND TRAVERSING JACKS, SCREW AND HYDRAULIC BEARS.

Box No. 1805, c/o "The Engineer."

A Seven-Day Journal

The Machine Tool Trades Association.

THE annual report and balance sheet of the Machine Tool Trades Association, to be presented at the annual general meeting on the 24th inst., of which we have received a copy this week, shows that the membership of the Association now stands at 124. During 1925 three firms were elected members and eleven firms resigned. In connection with the Empire Exhibition it is recorded that certain American machine tools which were being shown contrary to the regulations were removed as a result of representations made by the Association. At the same Exhibition certain machines made by a member firm were shown on the stand of a non-member. The member firm expressed its regret and was fined by the Council in a modified amount. The Council expresses its appreciation of the action of a member who declined to sell a machine to an outside firm for the purpose of showing it at an exhibition not approved by the Association. In many other directions the Association sought to protect the interests of its members. It took action concerning the effect of new tariffs and Customs regulations in the Dominions regarding the import of machine tools from Germany, got the Federation of British Industries to take up the important question of the standardisation of contracts, and collaborated with other bodies in securing the passing of the clause in the Rating and Valuation Bill which exempts process machinery from rating. Complaint was made to the United States Ambassador regarding an article in "Commerce Reports," written by an official of the United States Government stationed in London, in which reflections were cast on the quality of British machine tools. The members were warned that one firm had become involved in difficulties with a "journal" which sought material for an article and subsequently made excessive charges for the blocks prepared to illustrate the letterpress. A failure to secure from the railway companies the granting of half rates on unsold goods returned from exhibitions led to a decision to take the matter up again about a year before the next exhibition. In the event of renewed failure the Association will advise all its members to send their goods by road. The next exhibition of the Association will be held at Olympia during the two weeks and four days starting with September 5th, 1928.

Atlantic Air Service.

AFTER his recent flight from Spain to Argentina, which was undertaken with a view to showing that it was possible to create a regular air service between Europe and South America, Major Franco, the Spanish aviator, was refused permission to undertake the return journey by aeroplane. During eight months of the year the winds in the South Atlantic have a fairly regular velocity of about 30 miles an hour, and they assisted Major Franco on his outward journey. It was feared that had he attempted to return the winds would have so far reduced his commercial speed that he would have been unable to complete the longest portion of the flight, the 1400 miles between the island of Fernando-Noronha and the Cape Verde Islands. As the result of the experiment a new seaplane is being built at Pisa, with four engines of 500 horse-power each, in the belief that it will provide an ample margin for safely accomplishing the stage mentioned. Nevertheless, the commercial utility of such machines is being criticised on the ground that close upon 4 tons of petrol and oil would have to be carried to permit of the journey being accomplished without risk of supplies giving out, and that there would consequently be only a small margin left for postal and passenger loads. Such objections are being made more particularly by French experts, who regard the proposed air service as competing directly with the traffic service between Dakar and Pernambuco.

An Institution of Fuel Technology.

ON Friday, March 5th, over two hundred people assembled at the Institution of Civil Engineers, London, to discuss the formation of a proposed Institution of Fuel Technology. The chair was occupied by Sir William J. Larke, director of the National Federation of Iron and Steel Manufacturers. At first the proceedings were slightly complicated and endowed with a certain degree of liveliness by virtue of the fact that last November an organisation known as the Institution of Fuel Economy Engineers was brought into being at Nottingham to promote practically the same general objects as those designed for the proposed Institution of Fuel Technology. All were agreed that it was most undesirable to have two institutions dealing with the same subject, but the spokesmen of the Nottingham body, Messrs. Pope and Harvey, conveyed the impression that their Council was desirous of having the identity of its Institution preserved and recognised and not obliterated in the suggested amalgamation. After it had been pointed out that it was ridiculous to discuss the amalgamation of two bodies before one of them had been duly called into existence matters proceeded on a more regular basis, and in due course Sir Philip Dawson propcsed, and Sir Richard Redmayne seconded, a resolution to the effect that the meeting was of the opinion that an institute should be formed to promote the efficient production and utilisation of fuel, and to co-ordinate the work in this country and abroad designed to assist the scientific use of fuel in industry. The resolution was carried without dissent. An organising committee was thereafter appointed to prepare a report on the constitution of the proposed institution and the general basis for its organisation. The committee appointed included the names of Mr. David Brownlie, Sir Philip Dawson, Mr. L. C. Harvey, Dr. R. Lessing, Sir W. J. Larke, Mr. S. H. North, Sir Richard Redmayne, Dr. R. V. Wheeler, and Mr. David Wilson. The committee is to report to a meeting to be summoned not later than July 31st. Some support was forthcoming for the suggestion that the proposed body should be organised as a section of the Society of Chemical Industry, but the feeling of the majority appeared to be in favour of a completely autonomous institution.

An Aero-Engine Endurance Test.

ON Monday, the 8th, the endurance test of the Bristol "Jupiter" air-cooled engine fitted to a Bristol "Bloodhound" biplane came to a conclusion. At the close of the test the engine was still running perfectly satisfactorily, but as the mileage completed, 25,078 miles, had reached the figure aimed at, it was decided to stop the flights between Bristol and Croydon and strip the engine for examination. The trial began on January 4th, and since that date the engine has been running for 225 hours 54 minutes. No replacements to the engine have been made, although the total distance flown is greater than the girth of the globe at the Equator. The average fuel consumption, the mixture used being a 20/80 benzol-petrol mixture, was 21·9 gallons per hour, and the average oil consumption 3·95 pints an hour. The final run consisted of a non-stop flight from Bristol to Croydon and return, the outward half of which was covered in 38 minutes, corresponding to an average speed of 174 miles an hour. A full report on the condition of the engine as revealed after it is stripped is to be issued shortly.

Gas and Meter Testing.

IN his annual report, Mr. W. Duffield, the City of London Gas Examiner, says that the gas supply continues to be eminently satisfactory. In the case of number one testing station the minimum figure for the heating power of the gas on any one day was found to be 485·5 B.Th.U. per cubic foot of gas, whilst the maximum figure reached was 521·9. In the case of number two testing station, the minimum was 488·4 and the maximum 515·5. Tests made daily at the office showed even better results, viz., 479·1 minimum and 525·8 maximum, the standard heating power prescribed being 500 B.Th.U. During the year covered by the report 102,181 gas meters were tested, and the fees charged totalled £6211. As compared with the previous year, the number of meters tested decreased by 640, whilst the fees increased by £118, the increase being accounted for by the fact that small size meters are now made to pass much larger quantities of gas. Slot or prepayment meters are still in considerable demand, and no fewer than 53,118 of these meters were tested during the year.

A New Houlder Refrigerator Ship.

WE are able to announce that the Houlder Line, Ltd., of London, has placed with the Fairfield Shipbuilding and Engineering Company, Ltd., of Govan, Glasgow, an order for a motor refrigerator ship generally similar to the Upwey Grange, which was completed last year. An illustrated description of the Upwey Grange will be found in our issue of December 18th last. She is a 450ft. vessel of about 9130 gross tons, with holds of a refrigerated capacity of 564,000 cubic feet. The vessel is propelled by twin-screw marine oil engines of the Fairfield-Sulzer type, which are designed for a total output of 6400 brake horsepower when running at a normal speed of 117 revolutions per minute. The power developed corresponds to a sea speed of approximately 16 knots. We are given to understand that the main propelling machinery of the new ship will be practically identical with that of the Upwey Grange, but it is probable that in the final design some slight modifications to the ship's dimensions, and the type of engine-room auxiliaries used may be made.

The Krupp Losses.

AT the recent annual meeting of the Krupp firm at Essen, Herr Krupp von Bohlen, the head of the firm, gave some account of the year's trading and the general state of German industry. He stated that the industrial position was a difficult one, but that he was in a position to say that the Dawes Plan was being loyally carried out. The sales of the firm's products in Russia was making satisfactory progress. In a section of the annual report particulars were given of the material and machinery destroyed at Essen by the Inter-Allied Military Commission during the last five years. In all 9736 machines were broken up, or about 45 per cent. of the plant as it stood on November 1st, 1918. Some 801,423 dies, tools and jigs were destroyed, as were also 379 presses, tempering furnaces and cooling tanks, overhead transporters, &c. On the artillery ground 159 experimental guns and 11,000 tons of experimental ammunition were done away with. In the later months of last year 38 of the largest boring lathes, milling and shaping machines, which it had been hoped to retain for other industrial work, were broken up. One of the largest boring lathes was 177ft. in length and weighed 148 tons. Under the title of "The Technics of Destruction," the "V.D.I. Nachrichten," one of the organs of the German Society of Engineers, recently published an illustrated article on the destruction of these machines by means of a 10-ton breaking ball. The total replacement cost of the plant destroyed is estimated at 104,000,000 marks towards which sum the firm has received, we learn, about 40,000,000 marks compensation.

Threatened Engineering Lock-Out.

ON Friday last, March 5th, as the 900 strikers at Messrs. Hoe's printing machinery works in London had not returned to work, lock-out notices to take effect to-morrow (Saturday) were posted in all the works throughout the country attached to the Engineering and Allied Employers' National Federation. The notices applied to the seven unions to which the strikers at Messrs. Hoe's works belonged, and would, it was estimated, affect some 400,000 men all told. At the conference of the representatives of the union executives, held in London last Friday, it was decided that the strikers at Messrs. Hoe's establishment should be instructed to return to work. The duty of communicating this instruction to the strikers was left to the district committees of the unions concerned. On Monday a meeting of the strikers was held. No official instructions to resume work had so far been received, and it was reported that the men were still determined to remain on strike until their claims had been met. The district committees having declined to pass on the instructions to the men, the executive representatives decided to attend a mass meeting of the men on Wednesday in order to deal directly with them. The meeting, a somewhat stormy one, resulted in the men persisting in their refusal to resume work. The executive representatives thereupon conferred together with a view to taking disciplinary action against their recalcitrant members. In order to afford time for such action to be put into effect in accordance with the rules of the Amalgamated Engineering Union, a deputation from the executive representatives sought and obtained the consent of the Employers' Federation to suspend the operation of the lock-out notices until stopping time on Thursday, March 18th.

The Coal Commission's Report.

THE report of the Royal Commission on the Coal Industry was issued to the public yesterday, Thursday, morning. It divides the subject of the inquiry into two parts, one affecting the immediate situation and the other relating to the future reorganisation of the industry. In the first connection the Commissioners are emphatic in expressing the view that the continuance of the subsidy would be indefensible, that it should stop at the end of its authorised term, and that it should never be renewed. To bridge the gap between costs and proceeds the Commissioners reject the owners' proposals and submit that the minimum percentage addition to standard wages fixed in 1924 must be revised. They are opposed to any extension of the standard working day. The revision of the miniumm percentage will, it is held, save the coal mining industry from immediate collapse, but will result in the closing of several collieries. Government funds should be made available for the assistance of the labour displaced. Regarding the future reorganisation of the industry, the Commissioners urge that large changes are possible and necessary. They are opposed to the nationalisation of the mines, but hold that the ownership of the mineral should be acquired by the State. Small mines should be amalgamated and closer connection set up between mining and allied industries. Heat, power and light requirements should be placed under the constant survey of a National Fuel and Power Committee, composed of Government nominees. The State should enlarge its assistance to the industry in the matter of provision for research. New methods of winning and utilising coal must be found if prosperity is to be restored, and proper wages and working conditions assured. Nationalisation of the industry, the Commissioners state, would cost at least £350,000,000 and is open to grave economic dangers. On the other hand, the purchase by the State of royalties and underground wayleaves would cost £100,000,000, and on balance such purchase would have little effect on the State's annual budget. The Commissioners express the view that it would have been fortunate if 350 years ago the judges who decided the question had ruled that ownership of the mineral belonged to the State and not to the surface owner. The Commissioners believe that disaster is impending over the industry, but if the present situation is wisely handled the mining industry, with the aid of science, will certainly recover and even surpass its former prosperity.

The Technical Fair at Leipzig.

(*By our Special Representative on the Continent.*)

THE Leipzig Fair, with an unbroken history of many centuries, is undoubtedly one of the most important commercial events in Europe. Twice a year, in the spring and autumn, the town of Leipzig is transformed into a huge international market, where buyers congregate from all parts of the world. The Fair is international, in the sense that manufacturers from every country are invited to exhibit their wares and trade on equal terms with their German hosts, and several countries even organise their own national exhibitions; but so overwhelming is the preponderance of German goods that the Fair is in effect a German exhibition of enormous magnitude, advertising to the world in the most convincing manner possible the technical, artistic, and commercial power of the nation which organises it.

So vast has the Fair become that, to those who have not seen it, a considerable effort of imagination is needed to picture its extent. It includes everything from the heaviest machinery to the most delicate optical instrument and the finest product of the loom or the handicraftsman. To house it requires about a hundred exhibition halls, and no man could properly examine more than a small fraction of the articles on show during the week or so that the main Fair lasts. Everything, however, is done by the authorities to assist the visitor. Lodging accommodation at reasonable prices is found for him, meeting rooms for separate nationalities of visitors are provided at hotels and elsewhere, with well-informed interpreters in constant attendance, and business, which is, of course, the only object of the Fair, is facilitated in every way. Of recent years the attendance of both exhibitors and buyers has greatly increased, and at the last spring Fair no less than 14,000 firms exhibited. This spring, owing to the economic depression and the shortness of money under which Germany is labouring, the number of exhibitors has fallen to about 10,500, and buyers are also less numerous; but, even as it is, the Fair is a most remarkable evidence of the range and quality of the manufactured products of the country.

The interest of engineers in the Leipzig Fair mainly centres about the machinery and apparatus comprised in the Technical and Building Fair, which was organised as a separate section of the main Fair some eight years ago, on account of the growing number and importance of the exhibits coming under this classification. These were formerly distributed amongst the numerous Fair buildings of the town, but they are now concentrated in their own buildings on a separate exhibition ground adjacent to the imposing memorial to the Battle of the Nations, where Napoleon's power was shaken before his final defeat at Waterloo. The Technical Fair grounds and the buildings on them are on such a scale that this section alone of the Leipzig Fair would be considered a wonderful exhibition in any country. There are at present fifteen Fair buildings erected, the latest used for the first time for this year's spring Fair. Of them the finest is undoubtedly the Machine Tool Hall—Figs. 1, 2 and 3 on page 287—where the German Union of Machine Tool Manufacturers has provided an exhibition of machine tools which has probably never been equalled elsewhere.

We will first indicate the nature of the contents of the various halls, taken in numerical order, so as to give a general idea of the nature of the Fair, before dealing more fully with those of special interest to engineers. Hall No. 1 is given over to building materials, tiles, bricks, marbles, kitchen and sanitary fittings being typical contents. Hall No. 2 is concerned mainly with road-making machinery of every kind, and in addition a great deal of machinery, such as concrete mixers, road rollers, stone breakers, &c., is to be seen outside in the open air. Hall No. 3 contains domestic ovens and heating stoves. Baths, geysers, and fittings are the most prominent contents of Hall No. 4, while Hall No. 5 contains flour milling machinery, bread-making machines, refrigerators, and a considerable quantity of electrical apparatus. Hall No. 6 is the Bicycle Hall. Motor bicycles were by no means well in evidence, but ordinary "push bicycles," with their parts and accessories, made a good show. Hall No. 7, a very large building devoted to the German shoe and leather trades, was sadly empty. There was a certain amount of boot and shoe making machinery to be seen, but the leather trades in general withheld their support this year, on account of trade depression, with the result that rows and rows of empty stands gave an air almost of desolation to the great hall. Hall No. 8 was that of the motor car trade. German motor car manufacturers, like those of other countries, hold their own exhibition, and refused to patronise their national show at Leipzig. The agents of American, French and Belgian makers saw their opportunity, and although they failed to fill the hall, they put up a good enough show to enable a visitor to go away with the idea that foreign cars dominated the German market and that the national production, if any, was quite insignificant. There were, unfortunately, no English cars at Leipzig; as a matter of fact there were only thirteen British exhibitors out of a total of 10,500 exhibitors in the whole Fair. Hall No. 9 is the immense Machine Tool Hall, of which we have already spoken. Hall No. 10 is the main electrical exhibition of the Fair, although there was a quantity of other electrical apparatus to be seen elsewhere. There was no really heavy machinery on view, and German industry did not do itself justice with regard to the production of large machines. For impressiveness the Leipzig electrical show was not to be compared with that at Wembley, although perhaps it is not fair to compare an exhibition of ten days with one lasting six months. Electrical fittings, wireless apparatus, and small material generally, however, gave the purchaser an ample choice. With regard to power station switchgear, the finish and general appearance was very good, but to English eyes, at any rate, there was nothing to equal the ironclad gear as developed in England. A comparison, indeed, was possible at Leipzig, for in Hall No. 5 a Dutch firm was showing a large ironclad switch of the Reyrolle design, and no doubt the difference was noted by many visitors. The German switchboard instruments seemed also to lack the legibility of English instruments. The general impression made by this part of the show was that any pre-eminence the Germans may have formerly enjoyed with regard to electrical machinery and apparatus certainly exists no longer, even if the German product has not been surpassed by the British.

Hall No. 11 contained a variety of wood-working machines, textile machines, polishing machines, stamping presses, fans and minor apparatus, such as brushes, fire-bars and details of all sorts. At one side of the hall the composing and printing of the daily paper published by the Fair authorities could be watched. Hall No. 12 was mostly filled with small metal ware, and was not of great engineering interest. Hall 13 contained sewing machines, typewriters, presses, guillotine shears, bicycles, safes, calculating machines, and material for use in offices. The numerical sequence of the halls now ends, the next in order being No. 18, which was given over to a show by the Soviet Government. The exhibits consisted mainly of furs, seeds and grain of numerous kinds, wool, horsehair, feathers and other animal and vegetable products. Samples of ore, asbestos and naphtha were also exhibited. Manufactured articles included ropes, chair seats, carbon dynamo brushes, linseed cattle-cake which looked of inferior quality, toys and fancy wooden boxes. The toys were carved in white wood, and were presumably products of peasant industry, and they had a crude but really pleasing character. Some of the polished wooden boxes were really beautiful. Some examples of mantle-piece ornaments, such as horses cast by the "cire perdue" process, were noticeable, especially as the metal was cast iron. Literature in Russian and German, and forbidding-looking portraits of Trotsky and Lenin were on sale, but inquiries by Englishmen were apparently not welcome. The last Hall, numbered 21, was, after the machine tool hall, of most general interest to the engineer. An interior view of it is shown in Fig. 4, page 287. This was a special exhibition of "Brennstoff, Kraft und Wärme," and its most prominent feature was perhaps the number of oil motors shown by different firms. It covered a wide field, however, as its name implies, and comprised numerous oil and gas furnaces, fans, pumps, compressors, workshop heaters, foundry machines, boiler fittings, steam meters and other apparatus.

Broadly speaking, steam boilers, engines and turbines were all unrepresented at the Fair. In Hall No. 8 Krupps certainly showed something interesting to steam engineers, namely, a solid forged boiler drum for a test pressure of 800 lb. per square inch and a working pressure of 550 lb. It is for the new Rummelsburg power station to supply Berlin. The drum is practically 40ft. long overall, and has an internal diameter of about 60in. and a wall thickness of nearly 2in. Its weight is 25·5 tons. Another example of the interest taken in high-pressure steam was the section of part of a solid forged drum, 9ft. long by 50in. diameter and 2in. thick, shown in Hall No. 21 by the Schmidt Superheater Company, of Cassel. No complete boiler was noticeable at the Fair, and no steam turbine, except one or two very small units to drive pumps or fans. Air heating practice for furnace work does not seem so advanced in Germany as in England. The only air heater observed, apart from those for warming buildings, was one shown in Hall No. 21, which consisted of a number of horizontal rectangular tubes of sheet metal in a casing mounted on top of the boiler flue. In this type air passes through the tubes and the flue gases are diverted from the flue, so as to pass round them. The arrangement does not appear to be the most convenient form for cleaning.

It is hopeless to attempt now even to mention more than an insignificant fraction of the engineering exhibits, though we shall deal with some of them in special articles at a later date. We will therefore turn at once to the exhibition of machine tools, which was the most imposing display in the whole Fair, and deserves the most serious attention of British engineers, whether manufacturers or users of machine tools. The machine tool exhibition was organised by a combination of six of the leading trade groups into which the German machine tool industry is organised, headed by the machine tool department of the Charlottenburg University. The hall in which the exhibition was held is probable unequalled in the world for its purpose. The building, of which the front only is shown in Fig. 1, is 630ft. long by 273ft. wide. The exhibition hall itself is 370ft. long, and consists of three longitudinal central naves, with side aisles and galleries. The breadth of the three naves taken together is 165ft., and each nave is spanned by a 20-ton crane, so that the largest and heaviest machine tools in existence can be accommodated. The hall is further served by three tracks of standard gauge railway. The internal views—Figs. 2 and 3—really fail to convey the immensity of the structure, although they afford some idea of its nature. There were this year 765 stands, of which 555 were on the ground floor and 210 in the galleries. The pillared portion, seen in Fig. 1, does not cover the main exhibition hall at all, but is devoted on the ground floor to information and other offices, flanking the entrance hall, and on the gallery floor to restaurants. The machine tool makers had provided a separate catalogue of their exhibition, and, in addition, had organised an excellent service of information for the foreign buyer. If he was interested in any particular class of machine tool, he could consult with comfort a series of large boards, hung in a hall forming part of the information offices, on each of which the position of one particular class of machine was denoted by a red-headed pin. He had plenty of room, nice chairs to sit in and nobody to worry him. Professors Schlesinger and Kurrein, from Charlottenburg University, were accessible to all responsible visitors seeking technical advice or information on machining problems, and were ready with the most courteous and efficient help. As an example of the perfection of the organisation, it may be mentioned that an inquirer was instantly handed cards relating to the separate stands which he desired, or was recommended to visit, so that he could not forget either the name or the stand number. Each card, which was 8in. by 4in., contained an advertisement of the firm in question on one side, and the stand number, while the back was blank and suitable for writing notes upon. One can only say that if this kind of service did not lead to business, it ought to, if only for the excellent impression of courtesy and efficiency it created.

Considering the exhibition itself one could not help being struck by the care taken to make it both dignified and attractive. The eye was not affronted, nor was the view obstructed by any advertising boards or other structures announcing the names of exhibitors. At every corner of each stand was a sort of sign-post carrying a small standardised green-painted panel on which the name of the exhibitor and the number of the stand were painted in legible white letters. These were neat, unobtrusive, but thoroughly effective. Equally standardised were the boundary fences of the various stands, which consisted of gilt chains festooned between low pillars. The exhibitors had no offices of any kind on the stands, which contained, besides the machinery, nothing more than a desk or table and a few chairs. Green cocoanut matting covered the passage-ways and made walking comfortable. Quite 90 per cent. of the machinery exhibited appeared to be either continuously in motion or able to be put in motion should a visitor wish to see it running. A very large number of the machines, indeed, were working on actual jobs, and although possibly the feed was generally stopped in order to economise metal, a machine would be instantly put into full work if a visitor appeared interested in it. This remark applies equally to the largest as to the smallest of the machines on view. Henry Pels, for example, insisted on demonstrating the action of one of their shearing machines by cutting the end off a 16in. by 6in. steel joist, and had not the writer expressed himself contented by the sight of work already done they would have sheared off a steel billet, 8in. square, in another machine, to convince him of its ability to perform such a heavy task. This particular machine weighed 100 tons and was certainly one of the sights of the exhibition.

Schiess-Defries, of Dusseldorf, was another firm whose exhibit immediately arrested the attention of visitors on account of the size of the machines shown. The largest of them was a horizontal boring, milling, and drilling machine, of which the main column reached nearly to the height of the crane rails, as will be seen in Fig. 2. The spring spindle is 8¼in. diameter and the machine is driven by a 26 horse-power variable-speed motor with push-button control. The motor is carried on the spindle frame, on which all controls are mounted. The spindle is capable of a vertical travel of 16ft., while the pillar can also travel for 32ft. on its horizontal bed. One more firm deserves special mention for the size of machines exhibited. The Kalker Maschinenfabrik, formerly known as Breuer Schumacher, of Cologne, showed a vertical boring mill with a table of 12ft. diameter, weighing 40 tons. This machine was driven by a 30 horse-power variable-speed motor with push-button control and the speed can be raised or lowered or the table stopped and reversed with the utmost ease. The suddenness with which so heavy a table can be stopped is remarkable. The firm builds similar machines with tables up to 40ft. diameter, capable of taking work weighing up to 130 tons on the table. The Kalker Maschinenfabrik also showed a heavy lathe with 24in. height of centre. The bed, which carries two saddles, is of the most massive construction and is supported for its whole length by the

THE LEIPZIG FAIR

FIG. 1—THE MACHINE TOOL HALL

FIG. 2—THE SCHIESS-WEG IN THE MACHINE TOOL HALL

FIG. 3—ONE END OF BECKER-WEG IN MACHINE TOOL HALL

FIG. 4—VIEW ALONG HALL 31

foundations. The weight of the whole machine is 21 tons, and it is driven by a 25 horse-power variable-speed motor with push-button control. Machines of the same type are built up to 48in. height of centre. Among the smaller machines doing heavy work a thread miller on the stand of the Wanderer-Werke Company, of Schoenau, near Chemnitz, was noticeable. It was cutting a square thread of 2¼in. pitch and 1⁹/₁₆in. deep, on a shaft about 6¼in. diameter. The machine is capable of even heavier thread milling, its limiting capacity being a square thread 1¾in. deep on work up to 10¼in. diameter and 59in. long. The chips from the milling cutter fell into a trough, the bottom of which was formed by a conveyor band of perforated steel, so that the chips were simultaneously drained and carried away to the end of the machine. All the machines on the stand of the Wanderer Company were notable for the fact that all flat surfaces, whether guiding surfaces or not, were finished by grinding, hand scraping being entirely eliminated. Provided that the lubricating qualities and therefore the wearing qualities of ground flat surfaces are equal to those of scraped surfaces, and there is really no good reason for believing them to be different, the practice of grinding such surfaces is an advance on hand scraping. It is said that a certain British tool maker many years ago obtained the truth of his sliding surfaces by grinding, but was compelled to disguise the fact by lightly scraping them afterwards in order to meet the demands of fashion. The Wanderer Company has adopted no such artifice, but leaves all sliding surfaces exactly as they come from the grinding machine.

One of the machines of really new design at Leipzig was a centreless grinding machine exhibited by Mr. Carl Unger, of Hedelfingen-Stuttgart. It was at work grinding the circumferences of small rollers about ¼in. diameter by 2in. long, though samples of work done by the machine up to about 3in. diameter were also shown. The rollers were fed endways into a magazine. As they emerged from the bottom in a continuous flow they were caught between rotating friction rollers and pushed forward horizontally end to end like a solid bar through a guide groove. Above this groove a grinding wheel rotated, the spindle of the wheel being horizontal, but set askew with the groove. The circumferential face of the wheel ground the rollers as they passed under it. For the rollers to be finished parallel it is evident that the face of such a wheel must be hyperboloidal, so as to get a straight line contact with the cylindrical roller surface. In the machine in question the wheel is kept true to form by a diamond traversing across it in the same vertical plane as the axis of the work. The angle of the grinding wheel with the work is adjustable, as it has to be varied to suit the diameter of the work. The machine appeared admirably adapted for the rapid production of such things as rollers, which it is tedious or inconvenient to grind between centres.

As it is impossible to convey any adequate idea of the Exhibition by picking out for description a few tools from the thousands shown, it is necessary to sum it up in general phrases. There did not seem to be missing any kind of machine, from the largest to the smallest used in the machine shop, turnery, press shop, automatic department, tool-room and pattern shop of an engineering works. The Exhibition also contained numerous examples of machines which are on the borderland of machine tools, such as nut and bolt forging machines, power hammers, &c. The individual drive by electric motor was the rule, even for machines of quite small size, the motor being generally built as an integral part of the machine. Frequently an ammeter face was visible in some convenient part of the framing, so that the operator could note the power being consumed. Vertical motors were used as freely as horizontal motors, whenever a greater simplicity of drive could thereby be effected. Motors, as a rule, were of the totally enclosed type, with their stators-castings flanged out at one end for bolting to the machine framing.

Inquiry and observation elicited certain facts which indicate the trend of the German machine tool trade. That it is highly and efficiently organised the Exhibition alone is sufficient proof. There is a strong and growing tendency for makers to limit themselves to the construction of certain types of machines, and for those making any particular type to enter into close working agreements, under which each confines himself to a certain range of sizes, and passes on inquiries or orders for other sizes to an associated firm. Arrangements of this sort obviously cheapen and facilitate manufacture, for each firm can concentrate its whole energy on the class of work most suitable for its equipments. Jealousy is obviated by a financial agreement, whereby the profits of each firm are shared amongst the group. Having limited its production to a certain range of articles of certain types and being, to some extent, protected in developing that field, a firm will naturally make an intensive study of its products and standardise details as far as possible. Thus we find standardisation of whole units of construction, such as feed-boxes for drill presses, &c., one size and type of feed-box being used for the largest possible range of machines. Special machine tools, such as multi-saddle, multi-tool centre lathes for the rapid production of standardised parts were also in evidence.

In conclusion, it may be said that the Leipzig Exhibition was sufficient in itself to show that the German machine tool industry is not only a thoroughly organised and self conscious body, but that it has the vitality and energy to advertise itself to the world in a supremely effective way. If the organisation of the Exhibition could not command success, it at least had deserved it. Staged in a hall which would be a credit to any city in the world, the German machine-tool makers had put together an incomparable show of their products. The cost of bringing exhibits such as those of Messrs. Schiess and of the Kalker Company from Dusseldorf and Cologne respectively to Leipzig—a matter of some twelve hours in a passenger train—to say nothing of that of their erection and dismantling, must have been enormous. That any firm can afford to incur such an expense for a three weeks' Exhibition, for that is the whole duration of the Technical Fair, is no mean advertisement in itself. Nor need any firm have been ashamed to submit its products to the critical examination of visitors from all parts of the world. The workmanship and finish were of the best and where metal was wanted it was there in full measure. Whether the business actually done at the Exhibition was great or small we do not know, but it is certain that thousands of potential machine tool buyers must have gone back to their homes with an ineffaceable recollection of the magnitude and efficiency of the German machine tool industry. It is a matter for consideration whether British interests do not demand a British Information Bureau at subsequent Leipzig Fairs, where thoroughly competent officials and linguists of the various British Trade Associations would be present, ready to answer questions on the spot and to put visitors into touch with appropriate British manufacturers.

Notes on British Railways by a Continental Engineer.

No. VI.*

Shunting and Switching: Coal Premiums.

The great rapidity of shunting operations of all kinds, whether of passenger or goods trains, accounts for a large proportion of the efficiency of the British railways. These operations are carried out with the regulator well open, at a good rate of speed, and in every case without the reversing gear being "notched up" so as to give full admission, and the strong exhaust blast shows that economy of fuel is less sought after than is saving of time. The drivers can therefore operate their engines with great promptitude, and the marshalling of a goods train, for example, is effected much more quickly than on the Continent; occasionally, as I can testify personally, with disconcerting rapidity. It provides a demonstration of one of the aggravating consequences attaching to coal premiums, which have necessitated, in some countries, the institution of a veritable administrative office, which calls for the employment of a large staff of clerks, and the result of which is, in large measure, to imbue engine-drivers with exaggerated ideas of economy, apart altogether from the maintenance of a regular service of trains, for which the necessary quantities of coal are allotted to them, and for which they have to keep to fixed time schedules.

The rapidity of these shunting operations, which are carried out without whistling and without any orders apparently being given, as well as the initiative of the servants, help to give a distinguishing character to the British railways. Likewise the starting of the trains is effected rapidly, the drivers not being in the habit of "notching up" before the train has well run up to speed. It has something manly and energetic, gratifying to see for an engineer.

All the engines in service, and even those in the shunting yards seem always to have a full head of steam, and more often than not their safety valves are blowing off slightly. When the regulator is closed the blower is kept more or less at work, either to prevent the production of smoke, or so as not to allow the fire to get too low.

It is true that many British companies give coal premiums, but, as far as I can understand, they do so simply to encourage the best men, which is, of course, a rational proceeding in a country in which the fuel is of such good quality and relatively so cheap.

The disadvantages of regular coal premiums, such as are customary in most continental countries, are numerous and have a repercussion on some branches of the services. The *personnel* may see in all demands that may be made on it, such as the lessened production of smoke and more rapid starts, an additional expenditure of fuel. It thinks too much of its purse. Although devotion to duty has hitherto remained at a very high pitch among the engine-drivers on foreign railways, it would not do to interfere with the coal premiums. Locomotives when running are well enough fired by small quantities of coal put on at short intervals. That is old tradition, but when shunting is going on, or when suburban or stopping trains have to stop and start frequently, or when they are standing in the stations, the effects of the coal premiums are readily visible. The driver never sets his blower to work unless there is a fall of pressure in his boiler, for fear of uselessly burning fuel, of which a set proportion belongs to him.

The fault is perhaps less attributable to the drivers than to the insufficiency of the quantity of combustible allocated for shunting, the railway authorities not having perhaps realised the importance of carrying out these movements rapidly and that "Time is money."

As to the stokers and drivers I have no particular remark to make. In all countries, with any pretence at civilisation, they are a body of men possessing, despite the difference of nationality, singular affinities one with the other, which stamps them as belonging to the same profession. The continental drivers, in spite of anything I may have said regarding the coal premiums, are second to none. The running of the important fast trains, in France for instance, leaves absolutely nothing to be desired, while the tasks of the drivers conducting them are frequently more difficult than those of their British *confrères*, for their trains are hauled by very large engines and frequently weigh more than 500 tons net, while the fuel they have to use is not of the same quality. To sum up, the running departments of the French Railways have always responded to the demands made upon them, whether to haul heavier loads or to run at increased speed—frequently the two together.

British railways, which have not to face the same administrative obstacles, in addition to the rapidity of making up and dispatching their trains, carry out some operations which are sometimes really remarkable. I will choose, as an example, from among many others, a normal and every-day operation which I have had the opportunity of witnessing, namely, the breaking up in Crewe Station of an express arriving from Euston into three portions—for Scotland, Liverpool, and a third direction. The whole operation was performed very quickly, without the giving of any order, without apparent haste, without the intervention of any station official, in less time than it would take to describe it, semaphore signals giving the sole directions, the operations being possible because of the good arrangement of the lines in the station. Four minutes after the arrival of the train from London the three sections were on their journeys to their destinations, and the platform freed. Foreign lines should take account of what can be gained in time by simplifying the rules and regulations. But the intervention of excessive control by the State, under the pretext of ensuring safety, is only, in effect, an obstacle placed in the way of private initiative.

It is undeniable that the general use of the high platform in England, which is found at all stations without an exception, contributes materially to the rapidity of the working of the trains, and even to the security of the passengers, for it prevents them from crossing the lines, and compels them to use either an overbridge or a subway.

In all these directions great progress is every day being made on the Continent, the young generation of engineers seeming to be desirous of departing farther and farther from beaten tracks, and it is most desirable that they should not consider the mere speed as the last word in progress.

I have several times mentioned the draught in British locomotives. On this subject there are points which appear to be interesting. In most continental locomotives the exhaust is variable, whereas, on the other side of the Channel, the exhaust nozzle is fixed. That is one of the differences in application concerning which one cannot form an *à priori* opinion. In principle, the action of the exhaust is proportional to the weight of the escaping steam, and consequently to the evaporation. It is an automatic device which, at bottom, is the locomotive itself, and constitutes one of those applications the simplicity of which—only equalled by their efficacy—one must admire. However, in order that this efficacy may be complete, it is necessary that the quality and nature of the combustible should only vary between narrow limits. That condition is fulfilled in England, but it is not everywhere abroad. On the Continent, in France for example, the same tender, whether it be used for quite different services or for the same service continuously, may be loaded with two or three different kinds of fuel—large coal, briquettes, or small coal. The variable exhaust has the effect of equalising this circumstance, which is the outcome of local conditions and of the high price of the fuels available. By means of it, it is possible to vary the draught to suit the coal being burnt at any one moment, and to prevent the carrying away with the blast of unburnt small coal. There is also a reason of another kind: British locomotives are, normally, more pressed than those on the Continent, and their fixed exhaust nozzle represents the minimum sectional area for running at full power. Besides, the openings in the fire door reduce the quantity of small coal entrained by the exhaust. It is otherwise on the Continent, where, if the driver wishes to put on a spurt, he has to lessen his exhaust aperture, which sometimes allows him to restore the pressure in his boiler, when it tends to fall.

A material fact has proved—if there were any need

* No. V. appeared March 5th.

to have other proofs than those afforded by every-day experience—that the British locomotives are called for a given grate area to develop, normally, more power than are those of most other European countries—I do not speak of the United States of America, where combustion is sometimes pushed even further—where the fuel is lighter on the grate. The fact to which I refer is that the three compound de Glehn engines which were purchased twenty years or so ago by the Great Western Railway, while admittedly giving good service, had the reputation of not steaming quite so freely as did the normal types of engines of the same company, of more or less equal size, and that owing to that fact they sometimes found themselves in difficulty, the exhaust, because the engines were compound, not possessing the necessary energy. But the type of fuel, as well as the method of firing, were entirely different from those in their country of origin.

I believe that it can be considered as roughly true that a grate area of 26 square feet in an English engine corresponds to a grate area of 32 square feet in a continental engine, but the difference decreases as the grate area increases, or as the fire-box is made shallower, for combustion cannot be pushed so far on the grate of a "Pacific" having an area of 45 square feet, for example, as is possible with a grate of 24 square feet.

It seems incontestable that the compact older type 4–4–0 engines normally produced more steam per unit of grate area than do the huge modern locomotives.

On the other hand, it is certain—and the recent trials on the Pennsylvania Railroad, of which an account was given in THE ENGINEER, showed it to be so—that the efficiency of the locomotive boiler diminishes at a rapid rate if the rate of combustion exceeds about 70 lb. of coal per square foot per hour, and that if the combustion be pushed as far as 180 lb. of coal per square foot per hour the efficiency is not more than 40 per cent. It remains, therefore, to determine how far we can go so as to arrive at the best conditions, taking everything into account, for the large engines are more expensive to repair, and in first cost. An English engineer once said, and there is a good deal in it, "the locomotive is not made to economise coal, but to burn it." It is, however, a remark that requires qualification, for though it may well be true with coal costing £1 per ton, it is no longer so when the fuel is as expensive as it is now.

LOCOMOTIVE RUNNING AND MANAGEMENT.

It does not do to consider locomotives purely from the points of view of weight, grate area and heating surface. Account must also be taken of the character of the work which they have to perform, and the manner in which their power is developed and employed.

I have said above that, per unit of weight, or, at any rate, of adhesive weight, the work required of British locomotives is higher than that demanded of engines on the Continent, and that they are able to respond to the demand is due to the exceptionally good quality of the coal, to the way in which it is burned, and to the intensity of the draught brought about by the violence of the exhaust, the drivers not being accustomed to "notch up," at any rate, not so soon after starting, as is done on the continental railways. I am well aware that British drivers have sometimes been blamed for not "notching up" more quickly, but I am led to think that it is often preferable to "press" to a greater extent engines which are in good repair, when the stoking is adequate, the coal good and relatively cheap. The steam may, perhaps, be used with a little less efficiency, but thanks to good stoking, combustion is effected under better conditions, so that, in the end, the overall efficiency of the locomotives is not lower than it is elsewhere, while identical service, up to the limit attained nowadays elsewhere, can be obtained with engines less powerful in appearance.

It is certain that in a locomotive, economy of combustible must be placed second to the necessity of producing, with a limited weight, all the power that is required; in a word, to reach the rate of combustion without which the locomotive loses its distinctive character. There is often a loss owing to insufficiency of air at reduced speeds, the volume of air necessary for complete combustion only being assured when the engine is working with a heavy draught, but it may also become insufficient if it is sought to press the production too far.

Now, the British railways have hitherto employed good methods of stoking, which, as a matter of fact, answered best with coal in big lumps. The coal is fed upon the grate in a thick layer, especially near the fire-door, and the fuel descends to the grate, towards the front, as combustion proceeds. At the front end of the fire-box the fire consists principally of incandescent coke, while at the rear the fire is less brilliant and combustion is, in some sort, effected in a manner somewhat similar to that which takes place on the automatic grates in the boilers of central electric stations. The combustible when first charged into the fire-box begins to distil off its hydrocarbons and the actual consumption of the carbon, and even of the carbon monoxide, is effected in the middle or in the fore part of the box. Such a procedure would be disastrous if there were not a copious admission of air above the ignited mass of the fire through the large openings made in the fire-door. These arrangements, with the addition of a brick arch and a deflector, insure smokeless combustion and constitute a system which permits of a maximum amount of power being obtained with a given grate area, while at the same time there is complete and economical combustion. The admission of air through the door is efficient when the combustible is specially fed in at the rear of the fire-box, the flames resulting from the combustion of the hydrocarbons forming a kind of curtain which raises this air to a high temperature so that it cannot be prejudicial to the tube-plates or cause a fall of pressure.

If, in a general way, the grate area can be taken as a comparative basis for measuring power, attention must be paid to the qualities of fuel used and to the methods of stoking employed, as on them depend the quantity of fuel which can be burned per unit of grate area. In reality, what should be considered is the quantity of coal that can be burned per hour, given that the arrangements are such that as complete combustion as possible is assured. High rates of combustion are only possible with coal which is inclined to cake, burned in big pieces or in briquette form, and with a good depth of fire. If the combustible is light on the grate, or contains a large proportion of smalls, a strong draught will cause too much loss by carrying away unburnt particles. In the same way, with coal which is non-bituminous, such as anthracite, rather active combustion can only be effected with a thin fire, and, consequently a large grate area is necessary. To sum up, it can be said that, to obtain equal evaporation, the grate area may be proportionately less as the depth of the fire is greater. That is the case with the majority of British locomotives as it was formerly in France on the P.O. with the Ten Brinck fire-box burning briquettes.

A point which has sometimes been rather neglected in the design of certain English engines—I have in mind, amongst others, the first large 4–6–0 locomotives of a certain line—is the ashpan and the free access of air to all parts of the grate. The trouble of not being able to get sufficient air to the fire is never experienced with deep fire-boxes, and is only met with when the fire-box has to be taken over a coupled axle.

The methods of operation of the English companies have not, in general and up to the present time, necessitated the employment of such large engines as those adopted in other countries of Europe, in France, especially, where the "Pacific" type for express passenger services, and "Consolidation," "Mikado," or even "Decapod" engines for goods trains have, so to say, become standard practice. No other engines are being built. In a country in which the fuel is costly and of a quality inferior to that of many parts of the United Kingdom, they constituted a great step in advance, for they allowed of the construction of heavy and comfortable coaches, and made it possible to have express trains weighing upwards of 500 tons. But, on some lines they have to make their return journeys at the head of much lighter trains, and then they are employed inefficiently. On the other hand, the retention in service during a too long period of old-fashioned and low-powered engines, sometimes necessitates double heading, which is a costly proceeding, that is becoming more and more rare. As long as the Great Northern, for example, kept in service its single driver engines, which it did for some time though they were very pressed, the employment of pilot engines had frequently to be resorted to. As soon as it adopted the "Atlantic" type, it was able to give up that practice, and now it is the "Pacific" type which is asserting itself.

The important French expresses, which are as a rule very heavy, run at high speeds, but a good many of the stopping and suburban trains—that is to say, on non-electrified lines—are rather slower than similar trains in England, which is not due to any defect in the Traction Department, which has always responded to the calls made upon it, but to the services arranged by the Traffic Department.

The employment of locomotives of great power has introduced a problem which has not yet been satisfactorily solved, unless it be in the United States of America. I have not got before me data which would enable me to compare the strength of continental vehicle couplings, with, for example, that of the British couplings, but I have reason to believe that the new couplings which are now applied to the French rolling stock are the stronger, and allow of trains up to 1000 tons in weight being employed. On the other hand, it appears that breakages of couplings, on passenger trains especially, are principally produced during stoppages, when the driver makes a too sudden application of the compressed air brake. Now, as I have observed, British drivers apply their air brakes with skill, and fractures of couplings with passenger trains are relatively rare.

The upkeep of British locomotives is well attended to, and that is the result, not only of the general care taken of everything and of the arrangements made, but also of the large number of engines ready for service, which permits of a less number of miles per annum per engine being run and of more frequent stops for overhaul and washing out. Repairs are, furthermore, facilitated by the simplicity of the engines, and by the robustness of the various parts. It is manifestly impossible to compare the repairs of a 4–4–0, or even a 4–6–0 locomotive, having two high-pressure cylinders and a working steam pressure of 180 lb. per square inch, with those of a four-cylinder compound "Pacific," with a working pressure of 230 lb. per square inch. From that point of view, one cannot blame the British companies for having retained, as long as they possibly could, simple engines of moderate dimensions. Besides, very great progress has been made in this direction in France, where the number of effective locomotives, of which a dozen years or so ago there was a great deficiency, has been greatly reinforced, especially with powerful engines. One line, which used to have to extend the annual mileage of its engines to a very high figure, has recently been enabled to reduce that distance by almost one half, to the great advantage of the service.

On British railways the valve gears are kept in excellent order on all types of locomotives, which is due partly to the good conditions under which they are operated and in part to the care with which they are looked after. The exhausts are always perfectly crisp and at equal intervals, and never, even at highest speeds, lose their regularity.

To sum up, British companies have every right to be satisfied with the general condition of their engines, which, on some of the lines, actually appear luxurious, a fact which cannot be without its usefulness in fostering the self-esteem of the *personnel*, and which is rarely found abroad to such a degree. The state of upkeep of the locomotives is often, in fact, a matter for astonishment to foreign engineers.

New South Wales Mining Industry.

HIS MAJESTY'S Trade Commissioner at Sydney, Mr. A. Simpson, has forwarded to the Department of Overseas Trade a statement by the Under-Secretary for Mines with regard to the mining industry in New South Wales during 1925.

The report states that while the value of the mineral production for 1924 was £18,623,000, and constituted a record for the State, being £2,332,000 in excess of the greatest production hitherto, there is every indication that the returns for 1925 will at least be as satisfactory as those of the year before, even if they do not eclipse them. The main factors contributing to this result are silver-lead, coal, limestone and cement. With the close of the year 1925 the aggregate value of the minerals produced in the State should, it is thought, have reached an approximate total of £403,500,000.

Operations at Broken Hill during the year were attended with gratifying results. The high average price for lead, silver, and spelter, together with an increased tonnage of ore raised, should, it is calculated, result in making the value of the production for 1925 much in excess of that for the previous year, which totalled £5,607,000. All the mines along the Broken Hill line of lode worked continuously during the year, the Block 10 Mine having been reopened and the Central Mine having so far coped with the underground fire as to obtain a good tonnage of ore. The tonnage of ore raised at Broken Hill during the year amounted to about 1,242,400 tons, or an increase of over 190,000 tons as compared with 1924, and in December the number of men employed totalled 5858, being over 450 more than the number engaged for the corresponding period last year. Operations on the Yerranderie field were retarded during the year, owing to industrial trouble.

With regard to copper, the low price ruling for the metal militated against the successful working of the deposits, but against that the high price ruling for tin stimulated interest, and it is anticipated that an increased production and a well-augmented value will be recorded for 1925. The output for 1924 was valued at £260,000.

It is estimated that the output of coal in the State for 1925 will have been approximately 11,000,000 tons. The highest output yet reached was in 1924, when 11,618,000 tons of coal, valued at £9,590,000 at the pit mouth, were obtained. The output for 1925, while falling slightly below that of the preceding year, will certainly be found greatly to have exceeded the average output, and a fresh record would probably have been constituted but for the recent shipping dispute. Of the estimated output, approximately 7¼ million tons were won in the Northern District, 2 million tons in the Southern District, and 1½ million tons in the Western District. These figures would indicate a falling off of approximately half a million tons in the Northern District and of 160,000 tons in the Western District, whilst the output for the Southern District remains practically unaltered. The total output of the collieries in the State from the opening of the coal seams to the end of 1924 has been 299,753,781 tons.

The coke trade was very slack, and it is considered that the output will show a marked decrease for the year.

The output of Portland cement for 1924 reached 272,300 tons, valued at £1,200,000, and was the highest recorded up till then, but, with the additions made to existing plants and another company added to the rank of producers, a substantial increase in production should be recorded for 1925. Steps are being taken towards the establishment of other cement works in the State, and the industry has reached considerable proportions.

Gold mining continues to come in for a measure of attention, and a slight increase is anticipated, but no discoveries of importance were recorded. The mining for the various other minerals, which will help materially to swell the year's production, was, on the whole, well maintained.

THE Tenth Aeronautical Exhibition (Salon de l'Aéronautique) will be held in Paris this year. The date of the exhibition has not yet been fixed, but it is expected to open towards the end of November.

Transatlantic Wireless Telephony.

AT the beginning of 1923 we had the privilege of being present at a demonstration of wireless telephony across the Atlantic. At the New Southgate works of the Western Electric Company—now Standard Telephones and Cables, Ltd.—we listened, during the early hours of January 15th of that year, to speech transmitted from 195, Broadway, New York, and, as reported in our issue of January 19th of 1923, the messages which were received over a period of practically two hours were replied to on this side by cable. The demonstration indicated that sooner or later a commercial system of wireless communication might be established between the two countries, although the engineers in charge of the test made it clear that a good deal more experimental work would be necessary before it could be definitely decided whether such a scheme would be practicable.

In all electrical communication systems, irrespective of whether wires are used or not, noise tends to make the signal unintelligible, and if the noise measured in the same units as the signal is nearly equal to or is greater than the signal, no amount of amplification will make the signal distinct. For good and reliable communication the strength of the received signal must be considerably greater than that of the noise, the limit of transmission range being set by the allowable disturbance ratio. The problems connected with simultaneous two-way wireless telephone transmissions are naturally much more difficult than those of one-way transmission, particularly where land telephone lines are also involved, and many difficulties, including those arising from interference, have to be surmounted. Although the daily newspapers have forecasted the early inauguration of a Transatlantic radio service and have actually announced the probable charges which will be made for calls between this country and America, in official circles these statements are considered to be altogether too premature.

After the Transatlantic test that was carried out in 1923 a committee was appointed by the Postmaster-General, under the chairmanship of Admiral Sir Henry Jackson, to investigate the possibility of a commercial wireless service, and during the past two years further experiments have been conducted under the supervision of this committee and in co-operation with the British Post Office. As our readers are well aware, wireless telephony transmitting apparatus has been installed by the Post Office in the new wireless telegraphy station at Rugby, thus making two-way experimental communication possible. During the course of ordinary routine work on February 7th two-way conversation tests were made from 4 a.m. to 7.30 p.m. with very promising results, the tests being undertaken by the station staffs at Rugby and in America. At the time the conditions of the ether were abnormally favourable for wireless transmission, for there was little atmospheric disturbance or noise. The quality of the speech in both directions was clear and free from distortion or fading, and the voices of the individual speakers could easily be recognised.

On Sunday, March 7th, another very successful two-way test was made, when we had an opportunity of carrying on a two minutes' conversation with one of the engineers at the headquarters of the American Telegraph and Telephone Company at 24, Walker-street, New York City. For the first time in the history of wireless telephony a group of persons, consisting largely of representatives of the daily Press, was able to listen to conversation across the Atlantic and individually to converse with someone in America. Incidentally the demonstration took place on the fiftieth anniversary of the telephone. In England the circuit terminated at the London trunk exchange of the British Post Office, whilst in America it ended at the long-distance telephone headquarters of the American Telegraph and Telephone Company. As the diagram Fig. 1 indicates, in transmitting from London the speech is carried by underground telephone wires about 80 miles long to the Post Office Rugby radio sending station, and thence by wireless to a radio receiving station at Houlton, Maine, U.S.A., a distance of 2900 miles, whilst from Houlton the speech is passed over 600 miles of telephone circuit to New York City. In transmitting from America the speech is carried from New York to the sending station of the Radio Corporation at Rocky Point, Long Island, a distance of 70 miles, and from there it is sent by wireless over 3300 miles to a receiving station at Wroughton, near Swindon, where there is a Beverage aerial about 7 miles long. It is well known that this type of aerial has very marked selective properties and that it consists of a long and low horizontal wire pointing in the direction of the transmitting station. From Wroughton the speech is carried over a 90-mile telephone circuit to London.

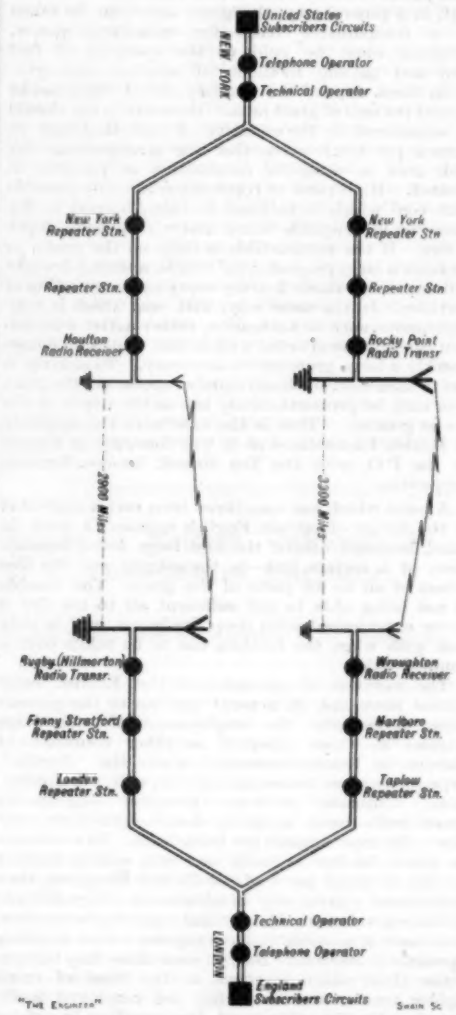


FIG. 1—DIAGRAM OF CABLE AND WIRELESS CIRCIUTS

The wave length utilised in England is 5770 m., whilst that employed in America is 5260 m.

On Sunday last the reception in this country left little, if anything, to be desired, and judging by the ready manner in which those at the other end of the system answered questions, it was equally good in America. Everyone present at the trunk exchange in Queen Victoria-street was provided with a pair of headphones and all had an opportunity of speaking to America, whilst the others listened to the conversation in both directions. The only hitch in the whole business was that a number of American journalists, who should have been at Walker-street, New York, at 9 a.m. (American time), to converse with representatives of various journals in this country, did not arrive until considerably later, with the result that some American engineers had to take their places.

Great credit is due to the engineers of the wireless section of the British Post Office for the manner in which the demonstration was organised. Before the test commenced Mr. E. H. Shaughnessy, who is at the head of the Wireless Department, delivered a brief and popular lecture on the complete system, and by means of lantern slides gave some idea of what wireless telephony across the Atlantic really entails.

Technical details of the wireless telephony apparatus at Rugby are apparently to be given in a forthcoming paper by Mr. E. H. Shaughnessy, who in the past has been kind enough to permit us to publish a good deal about the telegraphy section of that station. For the present, therefore, we cannot do more than refer in a general way to the system of radio communication that has been adopted, namely, the so-called single-side band system. Before the late Dr. Nichols, who was in charge of the test made in 1923, returned to America shortly after the test, he delivered a lecture before the Institution of Electrical Engineers on this particular system, which offers certain advantages, and in view of the renewed interest that has been aroused in the matter by last Sunday's test, we propose to give a brief summary of that lecture. In order to introduce the subject as easily as possible he first considered the simple type of circuit shown in diagram I, Fig. 2, where *a* represents a telephone line, *b* a battery which sends direct current through the circuit, and *c* the microphone, which varies the amplitude of the current or "modulates" the carrier current. The telephone receiver *d* consists of a diaphragm on which the electro-magnet can operate. When the microphone is operating, the amplitude of the carrier current, which is otherwise constant, is slightly varied, with the result that the current which flows through the telephone receiver is made up of two components—the constant carrier current or something almost exactly equal to it and the signal in the form of a variable ripple superimposed on the carrier. In the telephone receiver a deflection of the diaphragm is produced which is proportional to the square of the current passing through it. This is indicated by

$$(Ic + Is)^2 = Ic^2 + 2\,Ic\,Is + Is^2.$$

If Ic represents the constant carrier current and Is the signal the force on the diaphragm of the receiver is proportional to the square of Ic + Is, which is made up of three terms, Ic^2, which is constant, the middle term 2 Ic Is, which is directly proportional to the signal, and Is^2, which is proportional to the square of the signal, and consequently of double frequency, because any periodic function squared gives a constant and a double frequency component. The third term is consequently not required. If the received speech is to be of good quality the term Is^2 must be small as compared with the 2 Is Ic term—i.e., the carrier must be rather large as compared with the signal, and this condition is not met in the case of the simple telephone circuit No. I. in Fig. 2, which possesses two or three disadvantages applicable to a wireless circuit. The battery current or "carrier" current which flows through the line contains no element of the signal, and there is consequently really no need to transmit this direct-current carrier from the transmitting end to the receiving end, except as a means of producing the middle term 2 Ic Is at the receiver. Consequently the transmission of the carrier current through the line involves an unnecessary loss of power. Moreover, if the characteristics of the line vary, both Ic and Is in the middle term will vary and the variation factor in the received signal will be squared.

An obvious improvement can be made by employing the arrangement No. II. in Fig. 2, where transformers are introduced at the transmitting and receiving ends of the line. Clearly the first transformer restricts the carrier current to the transmitting apparatus, and the variations in this carrier current go through the transformer to the receiving end,

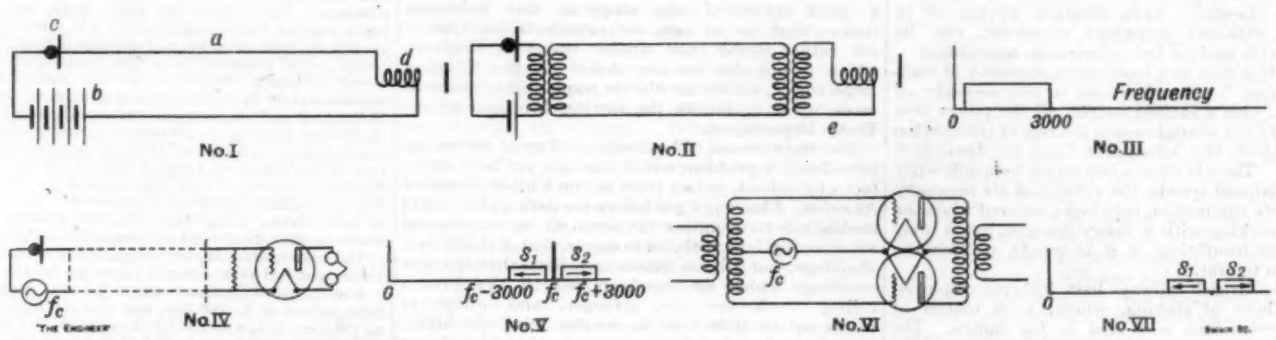


FIG. 2—DIAGRAMS EXPLAINING THE PRINCIPLE OF SINGLE SIDE BAND WIRELESS TELEPHONY

where only double frequency signals would be obtained, because the only thing that appears in the receiver is the Is term. To make the signals intelligible it is necessary to re-introduce the carrier current Ic, which is done either by placing a battery at *c* or a permanent magnet in the telephone receiver, thereby restoring the conditions which existed at the receiving end under the conditions indicated by the diagram No. I. In the diagram No. III., Fig. 2, the distribution of currents which must be passed by the line is plotted as a spectrum. In order to transmit intelligible speech a range of frequencies of something

like 3000 periods is required, and the microphone generates and the line must transmit a spectrum represented roughly by the rectangle on the left of diagram No. III. In diagram No. IV., Fig. 2, exactly the same arrangement is shown with the exception that the carrier current is an alternating one of frequency $f c$ and is delivered by an alternator. The microphone modulates the alternating carrier current and the result is to produce a spectrum represented by s_1, $f c$, and s_2, as in the diagram No. V. There is a carrier frequency component $f c$ and a band called the upper side band extending up to the carrier frequency plus 3000 periods, and also another band called the lower side band, extending down to the carrier frequency minus 3000 periods; in other words, the effect of modulating an alternating carrier by speech is to produce a spectrum twice as wide as the band which it is necessary to transmit. At the receiving end there is a device which operates in a similar manner to the telephone receiver; that is to say, currents in the output circuit of the valve are proportional to the square of the voltage applied across its input terminals. This means that the valve conditions are so arranged that if a sine wave be applied to the grid circuit a double frequency will be obtained in the output circuit. Exactly the same remarks apply in this case as in the case of the simple telephone circuit. A current is transmitted over the line having a spectrum as shown by the diagram No. V. The carrier component has no element of signal in it and there is no need to transmit it over the line. If it is transmitted, then the effects of variation in the line will be squared in the receiving circuit, and, moreover, it will be necessary to use much more power than would be required if it were not transmitted. Two important advantages are therefore to be derived from the practice of excluding the carrier wave from the line itself.

The carrier current may be excluded by means of the device shown in diagram No. VI., although other arrangements may also be employed. The carrier current is generated by means of the alternator shown at $f c$, and the speech which modulates this current is applied at the left. If no speech is applied and if the valves and transformers are quite symmetrical, the carrier current will produce no effect whatever on the output circuit, because currents will flow down in the upper part of the transformer winding and equal currents will flow up in the lower part of the winding. As soon as the microphone is spoken into, however, the valves will be unbalanced and the output will be proportional to that unbalance, the peculiarity about the output being that there will be no carrier frequency component present, as indicated in the diagram No. VI. Instead of obtaining the original spectrum as indicated in diagram V., a new one will be obtained which contains only one-third of the power of the original spectrum, but which still contains all the elements of the signal. As the two side bands are exactly alike it is not even necessary to transmit both of them. One of them—say, the upper band—can be cut out by means of electrical filters and all the elements of the signal will still be retained. If, however, at the receiving end the side band be applied directly to the receiving valve, the signal obtained in the output circuit of that valve will be unintelligible, because it is proportional to the square of the input and it will be of double frequency. If the carrier component be introduced at the receiving station in the same way as that described in connection with the simple telephone circuit and the signal then be detected, exactly the same condition will be secured as before. A component will be obtained that is directly proportional to the signal, which is what is required.

Wireless transmission must, of course, take place through what is known as the ether, which is more like a condenser than a copper wire, and consequently in order to get signals through it is necessary to use rather high frequencies. Moreover, the transmission characteristics of the ether are very much more variable than those of a wire. By employing the single-side band system there is a considerable saving in power, and the minimum frequency range is utilised in the ether, thus making more channels of commutation available.

To what extent the apparatus used for the recent tests differs from that employed for the American transmission in 1923 we cannot say, but presumably it is fundamentally the same. We commence, said the late Dr. Nichols, in his lecture before the Institution of Electrical Engineers, by developing a modulated wave at very low power by means of valves as used in telephonic repeaters. Both side bands are generated, but not the carrier, which is eliminated by the balanced modulator system shown in diagram VI in Fig. 2. By means of filters one of the side bands is cut out, because both bands are unnecessary, and a single band high frequency telephone current is produced. The next step is to amplify the low output up to about 300 watts and then, by means of another amplifier, up to about 5 kilowatts, the final stage of amplification taking place in a still larger amplifier capable of raising the power up to 200 kilowatts, which supplies the aerial. Only one side band of the modulated wave travels across the ocean, and, as explained above, by analogy, if an attempt were made to detect it alone, the speech received would be unintelligible, because all the frequencies would be doubled. Thus before detection is undertaken the carrier frequency component must be re-introduced—that is to say, the first frequency is generated as at the transmitting end. An oscillator is made to generate a current of this frequency and it is imposed on the receiving circuit and finally the combination is detected when the original speech is obtained, the resultant output of the receiver being amplified as much as may be necessary.

The illustration, Fig. 3, shows the Rugby transmitter power-amplifier units belonging to the telephony apparatus, and Fig. 4 the transmitter control table.

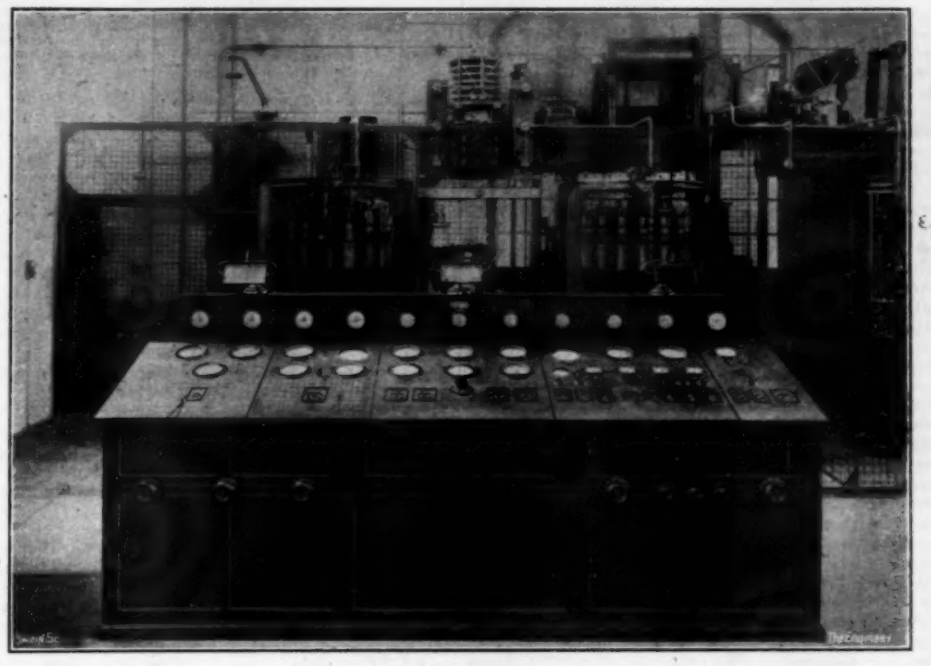


FIG. 4—TRANSMITTER CONTROL TABLE

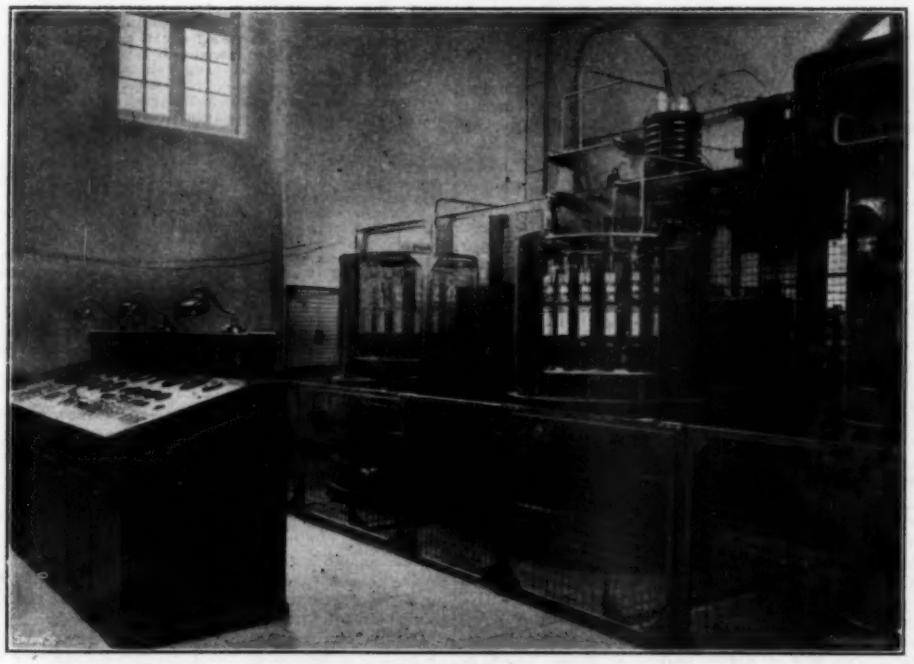


FIG. 3—TRANSMITTER POWER-AMPLIFIER UNITS

BALLASTING THE C.P.R. TRACKS.

QUOTING from a paper recently read before the Montreal Branch of the Engineering Institute of Canada by Mr. A. C. MacKenzie, the Maintenance of Way Engineer of the Canadian Pacific Railway, our contemporary, the *Canadian Engineer*, states that the total length of the Eastern Lines of that railway which have been ballasted with rock to date is about 1000 miles. It involved the use of about 3¼ million tons of crushed rock, or approximately 70,000 car loads.

The work commenced in 1916, and it is interesting to note that the rock ballast then used on main C.P.R. lines radiating from Montreal came from the Mount Royal tunnel, all the rock that had been excavated from the tunnel being bought for the purpose and crushed to the required size of between ¼in. to 3in. When this supply was exhausted material was obtained from the nickel mine dumps around Sudbury for the main line west of Chalk River and east of Port Arthur. Between Montreal and Quebec the supply was obtained from a rock-crushing plant near St. Vincent de Paul; for the main line from Vaudreuil to Toronto and from Vaudreuil to Ottawa, crushed rock was obtained from about 15 miles east of Smith Falls.

Mr. MacKenzie, according to our contemporary, described the operations involved in obtaining and crushing the rock at some length, and explained that economical conduct of this rock-ballasting work on a main line handling heavy passenger and freight traffic required very thorough and comprehensive organisation and the closest co-operation between the quarry, the ballasting gangs and the work train service, as, if they were not all thoroughly in tune, disorganisation and delays must immediately occur. How carefully organised the work was may be judged by the fact that the entire gang of about 200 men and 18 foremen were spread over a distance of about 13 miles in separate bodies, which were all connected together by two operators with field telephone equipment.

The method of laying the ballast employed is as follows:—The ballast is ploughed to a depth of 3in. below the top of the rail as it is unloaded. About forty cars are used per mile of track for this operation and an equal number for the next operation. They are unloaded at the rate of about a car a minute. A first gang follows the unloading of the new rock at a distance of about 2 miles behind this work, and a second gang follows the first with an interval of about 4 miles between them. The finishing up work on the track follows this second gang at an interval of about three days, or approximately 3 miles. Liming, surfacing and trimming gangs follow in the order named, and put the track to standard ballast section.

The Institute of Metals.

No. I.

The annual meeting of the Institute of Metals opened in the Hall of the Institution of Mechanical Engineers on March 10th. Professor Thomas Turner, the retiring president, occupied the chair at the opening of the proceedings.

The report of the Council stated that, not only has the Institute developed steadily at home and received increasing support from the non-ferrous and engineering industries, but its position is becoming increasingly international in character, as more than one-fourth of the members are now resident outside the British Isles. With the conclusion of the Locarno Agreement German members are beginning, once again, to resume membership; though the appreciation of the Institute by foreign scientists and manufacturers is very acceptable, it is important that the proper balance should be maintained and a larger proportion of home members is hoped for in the elections of the near future. The Corrosion Research Committee, in accordance with the reorganisation which took place last year, has continued the technical work connected with condenser tube corrosion. This work has been carried out at the Royal School of Mines, where apparatus has been arranged for tests on a much larger scale than previously. So far the results confirm many of the small-scale experiments, but a number of interesting new points have been observed. Useful information has been collected on the relative behaviour of different types of condenser tubes, and also on the effects of certain types of coating. A number of practical difficulties have arisen in connection with the working of the larger apparatus. They are being dealt with by a special sub-committee appointed for the purpose. The main investigation conducted during the past year was a study of the influence of iron compounds on corrosive actions and scale formation. Interesting observations have been made which appear to have a practical bearing on certain causes of condenser tube corrosion. Useful information has been collected on the formation of scales resistant to corrosion, but much remains to be done in this direction. An investigation of the practical conditions which produce local pitting has given a number of interesting results. The information, however, is not yet complete. During the year a number of cases of corrosion were examined, and valuable practical information was collected.

Professor Turner moved and Engineer-Captain William Onyon seconded the adoption of the report. The latter, referring to the work of the Corrosion Research Committee and to the pamphlet which has been issued, said that that document ought to be in the hands of every marine engineer. It told him what to do and what to avoid. The funds at the disposal of the Research Committee were, unfortunately, very limited, and unless more money was forthcoming the work would have to cease. In examining the list of donations to the Committee he had been struck by the fact that those who stood to gain the greatest benefit had subscribed the smallest amounts. He referred to the shipping companies and suggested that they should be approached again and asked to increase their donations. It would also assist the work of the Committee if failures of tubes in all ships were reported to the Committee. He had knowledge of the condition of the machinery of many ships which came into port and of the troubles which arose in the first place from leaky condenser tubes and the decision of some superintendent engineers to abandon the use of superheat. That troubles of this nature had arisen emphasised the need of liberal subscriptions towards the work of the Corrosion Research Committee.

The report was adopted.

It was announced that Sir John Dewrance had been elected president, that the vacancies in the list of vice-presidents had been filled by Engineer Vice-Admiral Sir Robert R. Dixon, Mr. W. Murray Morrison, and Sir Thomas Rose, and that the new members of Council were Mr. T. Bolton, Mr. H. A. Ruck-Keene, Dr. R. Seligman, Mr. James Steven, Mr. W. G. Turner, and Mr. H. B. Weeks.

Sir John Dewrance was then inducted into the chair by Professor Turner, to whom a well-deserved vote of thanks for his services was accorded on the motion of Dr. Walter Rosenhain, seconded by Mr. A. J. W. Smout, who referred to the valuable services in his professional work which Professor Turner has, over a long period, rendered to the metal industries.

The President said that the Institute was becoming recognised throughout the world as the central organisation for the non-ferrous metals industries and was doing very useful service. The international character of its activities had led to the arrangement of an autumn meeting at Liège from September 1st to 4th next.

The meeting then proceeded with the reading and discussion of papers.

The first paper taken was that by Mr. George Mortimer on "Die Casting of Aluminium Alloys."

DIE CASTING OF ALUMINIUM ALLOYS.

From the utility standpoint one of the interesting attributes of the metal aluminium is the ease with which its alloys may be "die cast." The economic value of die casting in general is now widely admitted and need not be unduly stressed here. It is so generally recognised that the die casting of brass and the bronzes have received close and costly attention of late, whilst in America at least one firm is successfully producing iron castings from permanent moulds. Neither in brass nor in iron, however, is the operation carried out with any of the specifications for aluminium casting alloys, nor do the moulds cost so little or last so long. This fact, coupled with the designers' long experience of these alloys under all sorts of service conditions, has been one of the more active influences in the very striking developments which have taken place in the past decade, in the application of die castings to engineering and industrial uses. The development in the use of die castings in Europe and America has not only been remarkably rapid, but has also inevitably proceeded on lines most suited to the conditions obtaining in different countries. Inevitably, also, a certain confusion arises in regard to the possibilities, technical and economical, of the different systems employed. The present paper is intended simply to crystallise the ideas of those who are interested in die castings, yet who are kept too fully occupied in their own legitimate sphere to keep in touch with developments in specialised branches of engineering.

Dr. R. S. Hutton welcomed the contribution as belonging to a type of contribution which the Institute required, concluding as it did an admirable survey of the present practice in die casting and giving an indication of the lines along which improvements in manufacturing processes might be sought. The weak points of pressure casting were clearly brought out in the paper. It was an interesting speculation whether a practical method could be evolved which would maintain the pressure during the process of solidification and pave the way for the production of castings of better quality than those now obtainable.

Mr. S. L. Archbutt said that the author's exposition of the subject would be very valuable to workers in that field. In the research on aluminium alloys which was being carried out at the National Physical Laboratory for the British Non-ferrous Metals Research Association the question of die-casting was included. There were great possibilities in die-cast aluminium alloys for engineering purposes, particularly the heat-treated alloys. There was something uncertain about pressure castings, which was bound up with crystallisation shrinkage and absorption of gases, and it was suggested that gas absorption might be averted by the use of nitrogen, which was apparently insoluble in aluminium alloys. With regard to the gravity system, 90 per cent. of the art of producing clean-cut sound castings lay in the design and adjustment of the gates, risers and vents. There were undoubtedly great possibilities in obtaining good properties for die castings, the qualities of which should approach those of forgings. The paper raised many interesting points and gave a great deal of information, and its presentation to the Institute was a sign that the old policy of jealously guarding trade processes was being abandoned, and that a spirit of real co-operation was taking its place. A firm putting out such a paper for the good of the cause deserved to pay a high rate of dividend.

Dr. F. Johnson put several questions to the author. It would be interesting, he said, if more data could be given as to the effect of zinc in molten aluminium. He noted that in connection with internal stresses in castings, no mention was made of the results of annealing, but his own idea was that the stresses could be removed by low-temperature annealing, the only question being whether that would be a suitable treatment in commercial work. He had personally tried the Cothias process on a small scale with brass castings, and his results suggested the possibility of extending this method to other alloys.

Dr. W. Rosenhain said that the paper raised many problems. One was that of crystallisation shrinkage. When an attempt was made to measure that shrinkage by casting in a sand mould between faces of steel templates a certain figure for total shrinkage was obtained, but it was found that alloys giving the same shrinkage behaved very differently, which suggested that it was not the shrinkage figure which affected the properties of the material, but when and how the shrinkage took place. It would be extremely interesting to have a record of the behaviour of these alloys from the foundry point of view. It was not a bit of good having a low shrinkage casting which contained large cavities or was afflicted with generalised porosity. If Mr. Mortimer could give some definite information as to the behaviour of differently cast alloys, it would be a valuable contribution to the data which had been collected. The question of obtaining soundness in castings which solidified in a metal mould raised many points of interest. The method of introduction into the mould and rate of flow of the metal were important factors. Nor was it only a question of the manner in which the casting solidified, but that of the liberation of gases which took place in any chill castings, although it was admittedly of a less violent character than in sand castings. The best castings contained gas voids, and suggested that the true line of progress in seeking to improve the quality of the product was to limit as far as possible exposure of the molten metal to air or gas. Whether the difficulty could be overcome by the use of nitrogen remained to be proved. Squeezing of the metal had been tried in the case of steel, but only when it was done on the Harmet process, which was very expensive, was any satisfactory result obtained. It was a very different matter to apply a process of that kind to aluminium alloys which were comparatively weak and brittle, and any serious amount of deformation during solidification might damage rather than improve the casting.

Dr. H. Moore welcomed the contribution of the author as based on long practical experience. The comparison made between pressure and gravity casting methods was most interesting, and the statement that the pressure method gave a less sound casting was very important. The real problem was to produce sound castings.

Dr. J. W. Jenkin, who has been associated with the work on aluminium alloys at the National Physical Laboratory, referred to the statement of the author when dealing with the gravity method of casting that it was of a more or less progressive character, as the mould was filled slowly. Was this an essential feature of the process, and was each layer automatically fed by the fluid layer above? There was also the question of the preheated mould, and he would like to ask whether Mr. Mortimer regarded temperatures of the range mentioned—350 deg. to 450 deg. Cent.—as detrimental in any other respect than to the life of the die. He would also like to know whether in the case of pressure casting the material of the containers was attacked by the molten aluminium.

Mr. Mortimer, in the course of a brief reply, which, he stated, would be amplified in writing, said that the use of nitrogen appealed to him as a very practical suggestion, and as far as he was aware it had never been tried. With regard to the application of pressure at a later stage of the process than in the ordinary pressure casting method, he had given a great deal of thought to that proposal. It occurred to him that something like an extrusion pressure would be required, and consequently extrusion temperatures would be involved, calling for the use of a very costly type of die, so that it would not be worth while in commercial work. The underlying idea of die casting, it must be borne in mind, was to produce rapidly and cheaply. Many questions had been asked. One was as to the effect of zinc in increasing the action of molten aluminium. He did not think it had any effect. Annealing to remove stresses was, however, regular practice, but in very small castings it was desirable to avoid the need for annealing, as the size of the specimen might be affected. Shrinkage had been referred to by Dr. Rosenhain; in his own experience a general figure was about 7 per cent. in volume. It was a somewhat abrupt change. To obtain a satisfactory casting it was desirable to get a slow feed at the eutectic point. The progressive freezing mentioned by Dr. Jenkin was not perhaps absolutely essential, but his own opinion was that it tended to give better results.

The second paper read at the morning session was one by Mr. R. W. Bailey, entitled "Note on the Softening of Strain-hardened Metals and its Relation to Creep."

SOFTENING STRAIN-HARDENED METALS.

The author suggests that the creep of a metal under stress is the necessary accompaniment of the softening or reduction by thermal influence of a strain-hardened condition and its simultaneous re-creation by further slip or strain. Thus, for example, it is suggested that under a given stress the rate of extension of a piece in tension is determined by the rate of softening, which in turn depends chiefly upon the temperature. The softening characteristics of strain-hardened metals are examined and it is shown that there is good reason to believe that generally the mechanism of softening is a definite characteristic of a metal uninfluenced by temperature except as to the rate of its progress, and further, that it takes place at all temperatures. It is shown that the law of softening is well represented by the relation

$$T = T_\theta e^{-b\theta}$$

where T is the time to produce a given degree of softening at a temperature of θ deg. Cent., T_θ is the corresponding softening time for a temperature of 0 deg. Cent., b is a constant for a given material which ranges in value from 0·05 to 0·09 for the metals examined, and e is the base of the Naperian logarithms. The author indicates that, neglecting the variation of the physical properties with temperature, which is of only secondary importance compared with the influence of temperature upon the rate of softening, a similar law would be expected to connect the life and temperature of a piece subjected to a given stress. It is stated that Dickenson's results support this deduction and consequently if L is the life of a test piece at θ deg. Cent. and L_0 is the corresponding life at 0 deg. Cent., the relation between life and temperature is given by

$$L = L_0 e^{-b\theta}$$

The author finds that for the metals used by Dickenson b has a value ranging from 0·046 to 0·07. In questioning whether there is a limiting creep stress the author states that a critical examination of published data shows that in most cases the limit of accuracy of the apparatus or method used has been mistaken for such a stress.

Mr. H. J. Gough congratulated the author on the remarkable results disclosed in the paper, which would be welcome to all workers in the same field. Concerning the theory advanced, he thought that more data should be collected before it was possible to express a definite opinion.

Dr. D. Hanson said that very little was known about the subject dealt with, and he agreed with the previous speaker that it was premature to advance elaborate theories. Mr. Bailey drew certain conclusions as to the connection between creep and elastic limit at high temperatures, but he hesitated to accept these somewhat sweeping conclusions, as there was some evidence which pointed in a contrary direction. In high temperature creep testing it was correct to say that at a certain temperature strain occurred, but at a particular point it ceased completely. It was also known that some amount of strain was necessary to cause recrystallisation at any temperature. There was, however, no justification for assuming that at any temperature up to the melting point strain would disappear as the result of heating. Much more work would have to be done

before definite conclusions could be stated with any confidence.

Dr. O. F. Hudson thought that the author had made some useful suggestions as to the phenomena of creep. He was in agreement with Mr. Bailey as to the importance of the distinction which should be made between creep and softening in work-hardened material which went on at the same time.

Mr. D. H. Ingall could not adopt the author's reasoning in its entirety, but it was certain he had done some excellent work. It was shown in a recent discussion at Birmingham on the properties of metals at high temperatures that it was a danger to interpolate curves of the nature given in the paper. It represented an attempt to draw comparison between two quite different things; softening in work-hardened metals and the phenomenon of creep. Until much more was known of the behaviour of metals under stress at high temperatures care must be exercised in making comparisons with metals which were not under stress.

The author will reply to the points raised in writing.

In the absence of the author, a paper by Mr. Samuel L. Hoyt and Mr. T. R. Schermerhorn on "The Hardness of Cold-rolled Copper" was brought up for discussion.

THE HARDNESS OF COLD-ROLLED COPPER.

Hardness tests of two series of cold-rolled copper bars are reported in detail, one which had received a 2 per cent. and one a 10 per cent. reduction in thickness per pass. These confirm the old or "conventional" form of relationship between the degree of working and the hardness. In neither case did the authors find either the anomaly noted by Alkins (the Alkins' effect) or the reversal noted by Rawdon and Mutchler. However, they do believe that they have observed a well-pronounced Alkins' effect on another series with heavier reductions, not recorded here. The deviations from a smooth curve which may be seen on the hardness curves may be accounted for as due to unavoidable experimental errors. The draft per pass had only a subordinate effect on the hardness, but, in the two cases reported in detail, the 10 per cent. reduction had a greater increase in hardness than did the 2 per cent. reduction per pass. The hardness over the cross section was found to be uniform for reductions above 20 per cent. At the start, with small reductions, the authors found the top surface to be harder than the side of the test bar. This difference disappeared at about 10 to 20 per cent. reduction.

Dr. Johnson referred to work of a similar character in which he had been engaged. The authors had been able to deal in their investigation with copper of low oxygen content, and comparatively pure and homogeneous materials. Reference was made to the ageing of work-hardened specimens, and he had himself carried out tests to show this effect. In Armco iron he had obtained very definite evidence of age-hardening. He noted that the authors were not prepared to accept the Alkins effect that at about 50 per cent. reduction there was a marked arrest in the rate of hardening. He had noted that effect, however, in his own work.

Dr. H. Moore said that at Woolwich it had not been possible to obtain any confirmation of the results given by Rawdon and Mutchler, and he had come to the conclusion that their work could not be accepted as reliable. The publication of their results had caused a great deal of the work to be repeated, and what had happened in this case was an illustration of the harm that might be done by the publication of inaccurate results. The paper contained much that was of interest, but further work was required before the explanations put forward could be accepted. The authors had indicated their opinion that Meyer's equation was correct, and he had no doubt on that point himself.

The annual dinner was held on Wednesday evening at the Trocadero Restaurant, under the presidency of Sir John Dewrance.

Mr. Bridgeman (First Lord of the Admiralty) referred to the excellent work done by the Institute in the field of marine engineering. It was to engineering organisations of that kind that the Admiralty would have to look for a solution of the problems which arose with the increase in mechanical appliances in warship equipment.

Sir Ernest Rutherford expressed the opinion that the development of industry would become more and more dependent on the metallurgist and the engineer. The great need was for a better understanding of the properties of metals, and rapid strides were now being made, of which the research into the crystalline structure of metals was an example.

Sir John Dewrance said it could be claimed that the Institute was a world-centre of metallurgical thought.

Standardisation in Industry.

CONSIDERATION by American industry and commerce of "Simplified Practice" as a means of meeting problems of investment, equipment, materials and time, has spread during the past year at a rate far surpassing that of any period since the Department of Commerce first turned its attention to co-operation with industry in the campaign for the elimination of waste in industry, says Mr. Ray M. Hudson, Chief of the Division of Simplified Practice. Over 500 industrial groups are in contact with the Division. In the iron and steel field, not including machinery, sixteen Simplified Practice recommendations are in effect, sixteen are in progress, and twenty-nine others proposed. The completed projects in effect at the beginning of the year included builders' hardware and eaves trough, conductor pipe, files and rasps, forged tools, sheet steel, terne plate, metal lath, plough bolts, milling cutters, steel lockers, steel reinforcing bars, hot water storage tanks, woven wire fencing and packages, range boilers, steel barrels and drums and hospital beds.

In this group Simplified Practice had brought important savings in money as well as collateral benefits. Estimated actual savings from reduced investment and other economies are given by leaders in some of these industries as follows:—

	Dollars.
Metal lath	2,000,000
Sheet steel and terne plate	2,400,000
Steel reinforcing bars	4,500,000
Range boilers	5,500,000
Builders' hardware	10,000,000

Nearing the Simplified Practice stage were items ranging from tacks and coffin hardware to elevated steel tanks and towers, and items which had been suggested for the co-operation of the Division ranged from steel wool and stove bolts to railway shop tools, steel stairways and metal doors. Consideration has been given to drop forged wrenches, pocket knives, warm air furnaces and stoves, but the application is progressing very slowly in these and a score of other fields.

Second only to the iron and steel field in its attention to Simplified Practice, it is pointed out, was the machinery field, in which forty-five items were under consideration. The commodities in which progress was nearing the actual simplification stage include machine knives, drills and reamers, H.R.T. boilers, carbon brushes for electric motors, and electric lamps. The suggested simplifications in this field enter into mining equipment, oil well equipment, pneumatic tools, farm implements, and other commodities. Consideration was also given to tubular coolers for dairies, pulley faces, electric stoves, mechanical stokers, machine tools and other items, in which, however, progress is very slow. Closely following in numerical importance was the non-ferrous metals group. Three of the programmes ready to be submitted to general conference of all interested parties deal with silverware, one with aluminium household ware, one with sheet metal, enamelled, galvanised and tin ware, and one with the sizes of fruit and vegetable tin cans. Proposed simplifications brought to the Division range from teaspoons to metal coilings, from oil cans to brass valves and fittings, also specifications for platinum alloys.

Of greater significance was the progress shown in the lumber field owing to the wide ramifications of that industry. In softwood lumber standards there had been an expansion of the standards and the completion of a report on opportunities for the utilisation of short-length lumber demonstrating the economies to the consumer from the use of this type of material. The decision of the hardwood industry to participate in the lumber standardisation movement was a great help in the progress. Simplified Practice programmes for box board—set-up and folding boxes—has been adopted by a general conference. The Division and the Wirebound Box Manufacturers' Association are working on a programme affecting the thicknesses of veneer and re-sawn lumber. The wooden box industry is also in contact with the Division.

The simplification of dimensions for mill work—windows, sashes and doors—is making rapid progress in the north-eastern section of the country, and is to be presented at a general conference in May for a more widespread adoption of this programme. Steady progress is being made on a simplification programme affecting wooden office furniture. Certain thicknesses of plywood and sizes were on the way to simplification. Proposals had been received for simplification in a dozen other items of wood construction, ranging from washboards and handles for shovels to wooden hulls for motor boats and piano woods. Estimated savings of over 200,000,000 dollars annually to the softwood lumber industry, and reports showing a greatly increased amount of softwood lumber cut to American lumber standards, were a great impetus to further action.

In transportation equipment work is actively under way to simplify brake linings, licence plates and brackets, oversize piston rings, spark plugs, ball and taper roller bearings. In the automobile field the National Tire Dealers' Association, manufacturers of motor cars and trucks, and others have indicated that the time is ripe for a simplification of automobile tire sizes. A programme is being considered by tire dealers for submission to the industries affected.

Work on the development of standards for marine construction, equipment and ship operation has been carried on by the American Marine Standards Committee under the sponsorship of the Division, which has 191 items under consideration, 44 per cent. of which are completed. Each of these has as its purpose an increase of efficiency in design, construction, and operation of ships flying the American flag.

SIXTY YEARS AGO.

THE use of steam traction engines for haulage purposes on common roads had become very common sixty years ago in spite of legislative and other interference. In Kent, thanks to the pioneering work undertaken by Aveling and Porter, the traction engine was very popular, but in spite of its habitual use no one, it would appear, was in a position to state definitely what was the real cost of moving a ton of goods by road with a traction engine. Mr. Aveling therefore determined to put the matter to the test, and on Monday, March 5th, 1866, a trial was begun designed to discover how traction engine transport compared with horse transport in point of cost. We personally were present at the trials, and in our issue of March 9th gave a full report of our observations and deductions. The traction engine was of Aveling and Porter's standard design, with a single 11in. by 14in. cylinder and a boiler supplying steam at 100 lb. pressure. It weighed about 14 tons in full working order. The train attached to the engine consisted of three wagons carrying 15 tons of goods and having a total gross weight of 21 tons. Rochester was left at 5.55 a.m., and Harbourne House, near Tenterden, was reached at 6.30 p.m. The total distance run was 26 miles, and the total time on the road 12 hours 35 minutes. The time lost on the road amounted to 3 hours 22 minutes, so that the net time for the journey was 9 hours 13 minutes, and the average speed something less than 3 miles an hour. The lost time included a period of 50 minutes for refreshments, 20 minutes for taking in coal, 20 minutes for repairs, &c., and 112 minutes for taking in water. Water was taken in on six occasions, the total amount reaching 447 pailfuls. The net consumption of coal was 23 cwt., and of water 1512 gallons. The expenditure on the coal was returned at 23s. Oil and cotton waste were entered at 3s. 6d., wear and tear on the engine and wagons at 8s. 9d., and interest on the capital cost of the engine and wagons at 3s. 6d. The labour charges amounted to 5s. for the driver, 3s. for the steersman, 3s. for an attendant, and 2s. for a "lad with flag." The total of these costs came to £2 11s. 9d., or a little over 1¼d. per ton per mile, the useful load of 15 tons alone being considered. This expense was, however, nearly doubled by the turnpike tolls that had to be paid. These tolls varied in amount from 3s. to 6s. 9d., were paid on eight separate occasions, and amounted in all to £2 3s. 6d., equivalent to 1¼d. per ton per mile. The total expenditure on the journey was therefore £4 15s. 3d., or at the rate of 6s. 4d. per ton for the 26 miles. By horse transport, so we recorded, the cost would have been about £1 per ton, or nearly three times as much. The Weald of Kent, we noted, was at that time exceptionally badly placed in the matter of turnpike tolls, and it was anticipated that the toll system would shortly be abolished altogether. To-day we have no turnpike tolls and "lads with flags" are no longer legal necessities. Even so, and in spite of all improvements and ameliorations, the cost of road transport is at least as high to-day as it was in 1866. While a 3-ton petrol lorry would do the journey from Rochester to Tenterden in about two hours, the all-in cost would be about 4d. per ton-mile, or about one-third more. For a table of costs of transport by different modern methods the reader may consult an article in our issue of November 17th, 1922.

THE INSTITUTION OF CIVIL ENGINEERS.

ANNUAL DINNER.

THE annual dinner of the Institution of Civil Engineers was held in the Hall of the Institution on the evening of Wednesday last, the 10th inst., under the chairmanship of Sir William H. Ellis, G.B.E. The guest of honour was the Prince of Wales, and his Royal Highness, after the loyal toasts had been duly honoured, proposed the toast of "The Institution" in an apt and thoroughly characteristic speech. It was, he said the first time that he had had the opportunity of thanking the Institution for electing him an honorary member, which it did seven years ago. Since then he had visited almost every corner of the Empire—indeed, of the world—and he would say, with all sincerity, that he had been struck with admiration—not once, but many times—by the astonishing achievements of engineers all over the earth. He counted his honorary connection with the Institution as something of great value to him. He liked to think that British engineers had, like the Romans of old, enriched the world with monuments of their professional skill. He had recently crossed the Andes by a railway which went as high as 10,000ft. It had been laid by British engineers. In concluding, he laid stress on the importance to us to-day of developing what was often called "labour-saving," but which he preferred to call "labour-aiding" appliances. In this particular direction he thought that the Americans had set us a very good example. Their study of those appliances and their successful development of them seemed to have a great deal to do with their industrial efficiency. He believed, he added, that the Institution—might he call it the "Academy of Engineering"?—could do a great service to the country by giving special encouragement to this special branch of engineering, which he considered to be very important. After Sir William Ellis had replied to this toast in a felicitous speech, the toast of "His Majesty's Ministers" was cleverly proposed by Lord Aberconway, to which the Lord Chancellor as cleverly replied. To the toast of "Our Guests," proposed by Mr. Basil Mott, the Lord Chief Justice and Sir Joseph J. Thomson, O.M., responded.

CORRUGATED FURNACES AND SMOKE TUBES FOR MARINE BOILERS.

A BRITISH standard specification dealing with withdrawable furnaces has just been issued by the British Engineering Standards Association. Its number and title are 3023–1926, Corrugated Furnaces and Smoke Tubes for Marine Boilers. Section I. of the specification deals with the furnaces of the Morison, Fox, Leeds Forge and Deighton types, all of which are interchangeable. The range of sizes specified are from 40in. diameter at mouth, increasing by steps of 1in. to 53in., giving a selection of fourteen different diameters. The radius at the neck of the four types of standard furnaces is the same both for those of maximum and minimum thickness. The plain part at the front end may be any dimension between 10½in. and 4½in. as required, and is suitable for furnace mouths flanged inwards or outwards.

Section II. of the specification deals with plain and stay smoke tubes for marine boilers and covers the manufacture and lays down expanding and hydraulic tests and a weight tolerance. The tubes may be of two types—those enlarged at one end and those of uniform thickness throughout. The stay tubes are screwed to the British Standard Whitworth form, having nine threads per inch. Copies of this specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria-street, London, S.W. 1, price 1s. 2d. post free.

IT is noteworthy that while the old two-track railway bridge crossing Newark Bay, New Jersey, which was built in 1863, cost 327,653 dollars, the new four-track bridge has cost nearly 10,000,000 dollars. The new bridge is said to include the heaviest movable spans in the world. They are raised vertically and the longer one has a span of 305ft.

A Large Electrically-driven Bakery.

THE new bakery which has recently been erected by St. Cuthbert's Co-operative Association, Ltd., and which, incidentally, is one of the largest bread bakeries in the country, is in the heart of the city of Edinburgh.

The St. Cuthbert's Co-operative Association has, from small beginnings, become a powerful organisation, and so rapid has been the growth of its membership that the continuous chain of new bakeries which it has built from time to time and the many extensions to existing bakeries that it has carried out have been unable to meet the demands made upon it. The directors therefore realised, some time ago, that a question of paramount importance was the selection of an entirely new site on which a bread bakery of a capacity adequate to cope with the present demand, which would also allow of extension being made in the future, could be built. It was recognised that, from the point of view of transport facilities, such a bakery would have to be centrally situated, and when it became known that the London, Midland and Scottish Railway Company purposed to discontinue the use of Port Hamilton Canal Basin the directors decided to purchase the site. Port Hamilton Basin, it may be mentioned, was one of the termini of the Edinburgh and Glasgow Union Canal, which was completed in the year 1822.

Development work on the new bakery was begun in 1922, and the first portion opened in February, 1925. When completed, the building will be in the form of a square and will cover an area of 5000 square yards. Three sides of the square are formed by four-storey buildings 68ft. in height, and the main building measures 244ft. long by 225ft. deep. The products from the ovens are discharged by means of an electrically-driven conveyor into a central cooling and despatch hall measuring 119ft. by 72ft., from which the products pass into twelve loading docks. The building is of steel and terra cotta pressed brick construction, the interior walls being of glazed brick or tile, and all window frames being of steel. It is worthy of note that sixteen hundred tons of steel, two million bricks and two thousand tons of cement were required for its erection, and that the buildings were put up by the Association's own workmen under the direction of Mr. John Baxter, master of works. The machinery installed in the bakery is of the latest and most up-to-date type, and the internal arrangements have been devised with the view to obtain the highest effect of continuous production. The entire bakery is equipped for electric driving, the necessary current being obtained from the mains of the Edinburgh Corporation Electricity Department, the supply being 460 volts direct current. The contract for the motors, of which there are forty, was placed with Bruce Peebles and Co., Ltd., of Edinburgh, through their agents, Mitchell Graham and Son, Ltd., of 56, Buccleuch-street, in the same city. The machines are all of the enclosed ventilated type. Most of the baking machinery is driven individually, but in one or two instances the subdivided group drive has been adopted. Of the baking plant installed it may be said that the Port Hamilton bakery stands as a striking example of the extent to which machinery can be used for the production of bread under hygienic conditions. The complete baking equipment was supplied by Baker Perkins, Ltd., of Peterborough.

On arrival at the bakery, the flour is delivered at the base of a continuous electric elevator and raised at the rate of 10 tons in sixteen minutes to the storage hall on the top floor. The elevator is situated outside the main building and is in the form of a lean-to on the left wall, so that it takes up no active space. The storage hall is worthy of note, in that it is capable of storing 8000 20-stone sacks of flour. As giving some idea of the strength which has had to be given to the floors, it may be mentioned that the weight on this floor alone, when filled to its utmost capacity, is 1000 tons.

Automatic flour plants, of which there are four, are installed on this floor. Two of them lead to the sponge stirrers and two to the dough kneaders on the floor beneath. Each plant consists of a blender, a chain bucket elevator, a spiral brush sifter, a worm conveyor, storage hoppers, and an automatic travelling weigher on iron tracks. The travelling weighers are situated over the kneaders on the floor beneath. Fig. 7, page 298, shows a series of four flour blending storage hoppers, the elevator, sifter, and conveyor being driven by a Peebles 7 brake horse-power, 675 revolutions per minute motor, which is seen with its starting panel in the left of the illustration. The sponging plant is served by four sets of storage hoppers, each capable of containing forty-five sacks of flour, weighing 280 lb. per sack, whilst the kneaders are served by five hoppers, each with a capacity of sixty sacks. An interesting feature of the hoppers is an electric tell-tale indicator which comes into operation when the hoppers are fully charged. The charge to the weighers, which, as already stated, are situated above the kneaders, is automatically con-

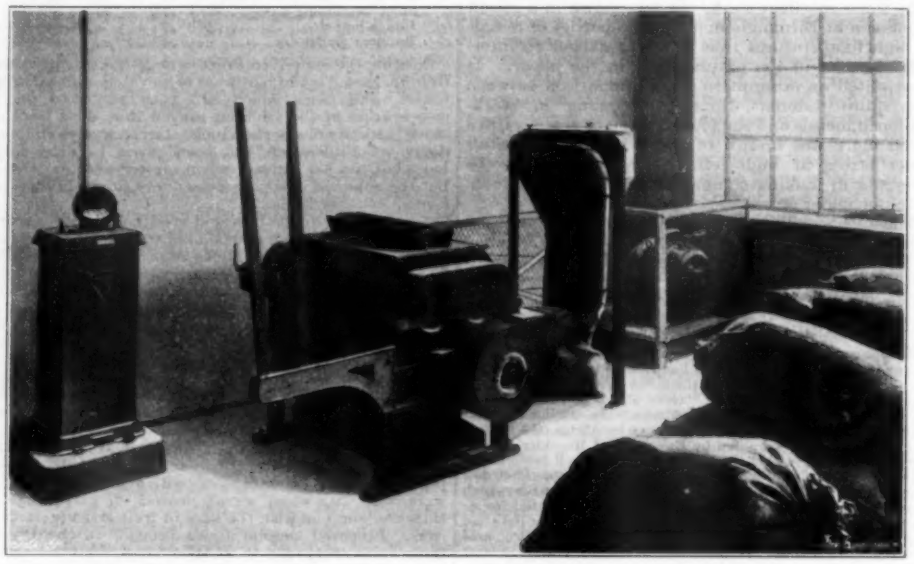


FIG. 1—ELECTRICALLY-DRIVEN SACK CLEANER

FIG. 2—ELECTRICALLY-DRIVEN ONE-SACK KNEADER

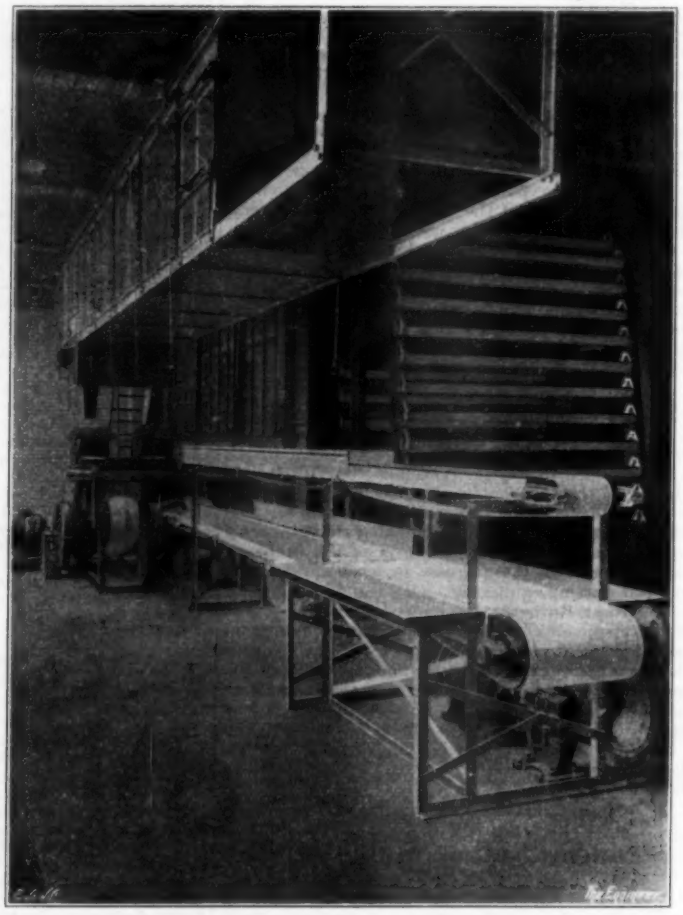


FIG. 3—AUTOMATIC PAN-BREAD PLANT, MOULDER AND CONVEYOR

trolled by an electric cut-out device. The flour is stored and conveyed as required to the hoppers, into which it is emptied, and as it passes through to the kneaders below it undergoes a thorough sifting and blending process. At the same time the passage of the flour through the sieve gives an aerating effect, which, it may be explained, is beneficial to the resultant loaf.

The empty sacks are cleaned by an electrically driven revolving beater machine, which is capable of cleaning sacks at an average rate of 200 per hour. Fig. 1 shows the sack cleaner, which is driven by a Peebles 3 brake horse-power, 700 revolutions per minute motor.

Next in the order of the processes comes the kneading, the necessary machines for which are, as has been stated, installed on the floor beneath the blending hoppers. There are four one-sack and six three-sack "Viennara" kneaders for sponging and doughing respectively. The kneaders are each constructed with a swan-necked arm with a hook at its extremity, which describes a motion which is similar to that followed by the human arm in a revolving pan. This treatment of the dough brings about the highest results and a maximum yield. Copper tempering tanks are provided and tub lifts are suspended from the ceiling over the pans. Fig. 2 and Fig. 8, page 298, illustrate the one-sack and three-sack kneaders respectively. The former are driven individually by Peebles 6 brake horse-power, 675 revolutions per minute motors, whilst the latter are group-driven by a Peebles 50 brake horse-power, 350 revolutions per minute motor. As is well known, continuity of service in a bakery is of first importance, and it was decided a "Baker-Perkins" patented oil firing apparatus, which includes burners, measuring tanks, fans, &c. It should be noted that the two plants and swinging tray ovens described above are designed purely for the production of pan bread. At the present time there is being installed on the same floor an exactly similar plant to work with a steam pipe oil-fired travelling plate oven, and a final prover of special design. This plant and travelling plate oven are for Scotch square close-set bread, and the plate consists of a travelling endless web of iron plates. When the loaves reach the delivery end of the oven they are perfectly baked, and are removed and placed in a shoot which takes them to the cooling room previously mentioned.

On the ground floor there are two similar plants, each serving a battery of ten oil-fired drawplate ovens. The ovens are equipped with the "Thomson Matchless" circulating system of tubing and the "Perkins" running gear and furnace construction, so that they comprise a combination of the two foremost types of ovens in their respective classes.

Fig. 5, page 298, depicts a divider, hander-up, prover and moulding machine for a series of ten drawplate ovens. The bread conveyor used in connection with the plant on the floor above can be seen suspended from the ceiling. The divider is driven by a Peebles 8 brake horse-power motor, whilst the moulder is driven by a Peebles 4 brake horse-power motor.

Fig. 6, page 298, shows the bread conveyor entering the cooling and despatch hall. It is driven by a Peebles 3 brake horse-power, 700 revolutions per minute motor.

It will have been gathered from the foregoing that

FIG. 4—ELECTRICALLY-DRIVEN DIVIDER

to install a stand-by motor for the three-sack kneaders. The spare motor can be seen in Fig. 8. On the same floor as the kneaders there are two "Thomson" barm and scald stirring machines. The tin or pan bread installations consist of two complete automatic plants, each of which includes a final prover and swinging tray travelling oven.

Two of the latest-type rotary-head dough dividers, with a flexible lath-type hander-up, are arranged on the same floor as the kneaders. The first provers, swinging tray provers, two "Girdwood" Scotch-type chaffers or moulders, capable of giving an output of 2400 pieces per hour, and the ovens are installed on the floor beneath. After being fed into the divider the pieces are untouched by hand until they have completed the final moulding stage, and they are then placed in tins on the trays of the final provers and proceed throughout these units until they emerge as baked loaves at the delivery end of the swinging tray ovens. The loaves are then fed from each oven on to a wire conveyor, which takes them through the floor into the cooling hall situated on the ground floor. Fig. 4 shows one of the dividers, which are driven by a Peebles 8 brake horse-power, 775 revolutions per minute motor, whilst Fig. 3 shows a "Girdwood" moulder driven by a Peebles 4 brake horse-power, 770 revolutions per minute motor, a conveyor driven by a Peebles 3 brake horse-power, 700 revolutions per minute motor, a prover and a swinging tray final prover. The ovens are provided with swinging or suspended trays which follow a circuitous route over a given time for baking, and when the loaves have been taken from them, the trays return over the top of the oven and final prover for refilling, as necessary. The heating of the ovens is accomplished by means of steam pipes, which obtain their heat from there are five automatic plants, and each is capable of dealing with 2400 pieces per hour. This number of loaves is equivalent to 12½ sacks of flour, each weighing 280 lb., or 62½ sacks per hour for the five plants. Working on a six-hour day, an output of 375 sacks daily is secured, and naturally if longer hours are worked the output is increased in a corresponding measure.

The main switch-room connecting the bakery electric system to the mains of the Edinburgh Corporation is situated on the ground floor. "Orb" switchgear is provided for controlling the different sections of the bakery, and ammeters and voltmeters show the nature of the load on any section at any moment. The main cables from the switch-room are run to "Orb" distribution boards on each floor, and from them cables are run in iron tubing to each motor. The fuses throughout are of the Home Office self-aligning type. All motors are controlled by Igranic starting panels, each panel being provided with an ammeter. In some instances "Igranic" automatic control panels have been installed, and they are operated by start and stop push button control points placed at three or four positions on the baking machines for the convenience of the operator.

The advantages derived from the use of electric power at a bakery of this type are obvious. There is no loss of power in driving idle shafting, the minimum amount of floor space is occupied, and power consumption can readily be checked. The bakery is a model of cleanliness, and, that it is so, is, without doubt, largely due to the electric drive.

We may add, in conclusion, that the welfare of the workers has by no means been overlooked, for bathrooms, dressing-rooms and dining-rooms have been provided for them.

Platinum in the Transvaal.

(Contributed.)

CAPE TOWN, February 19th, 1926.

THE crushing and treatment plant installed at the Onverwacht platinum mine of the Transvaal Consolidated Land and Exploration Company, Ltd., and the processes whereby the platinum-bearing ore is made to yield its content in the form of platinoid sponge, seem worthy of a brief description, seeing that the Transvaal mine is the first at which platinum, except in minute quantities, has ever been produced in South Africa, operations having started on January 13th of this year.

Ore is transported from the shaft to the head of the mill by means of small trucks running along a light tram track. There the coarse ore is separated from the fines on grizzley bars of the usual type. The coarse lumps are broken in a jaw crusher. The fines that pass through the grizzley and the product from the jaw crusher are then fed into a five-stamp, each of 1250 lb. weight, Sandycroft battery. The screening is of 1600-mesh, and the pulp then passes on to the primary concentrating plant, which consists of four Wilfley tables. A Wilfley ball mill of 50 tons per day capacity has been installed, but had not, up to a week back, been put to work. Additions to the power plant were, however, being made, and when they are completed the product from the mortar box after passing over a lip plate will be fed into the ball mill, where the ore will be more finely ground. This arrangement should result in an increased capacity for the plant, and will also, it is confidently anticipated, result in an improved extraction.

The plant has been designed so that the four Wilfleys take the pulp directly from the stamps and ball mill. The middlings from these tables are led to the secondary concentrator, which consists of a fifth Wilfley. The concentrations from each table fall into special locked steel boxes, while the tailings and other overflows from the five tables are finally led over corduroy strakes before passing to the tailings dam. It has been established that for the ore being treated fine grinding is essential.

The full output of the plant is expected to be 50 tons per day of twenty-four hours, when the ball mill is in circuit, but at present the stamps, crushing through 1600-mesh screening, are giving 25–30 tons per day. It is estimated that the concentrates produced have so far contained 85 per cent. of the precious metals in the mill feed, but with the ball mill in operation, when the plant, and with it its operators, have settled down it is confidently expected that that percentage will be improved upon.

From the concentration plant, the steel boxes are taken to the extractor house, where they are subjected to a special extraction process, devised as the result of experimental work by the members of the Central Mining Rand Mines metallurgical staff in their laboratories. This process is of an electro-chemical nature, the precious metal being finally recovered as an amalgam.

The whole process appears to be in no way more complicated or expensive than that seen in operation throughout the reduction works of the Witwatersrand, since the adoption of corduroy centration, and it outwardly resembles the local process very markedly. The essential point is, of course, the discovery of the method of altering the metallic contents in such a way as to make them amalgamable. The metallurgists of the Corner House, in common with the metallurgists of other Rand mining groups, have for some years past devoted considerable attention to the recovery of the osmiridium associated with the banket of the gold mines of the Witwatersrand. Their experience in this respect has stood them in good stead in evolving a method of recovering platinum, an element of the same metallic family or group as that to which osmium and iridium belong. A great deal of research and careful investigation has, however, been necessary, and Mr. Kenneth Graham, the chief metallurgist of the Rand Mines Group, and his assistants, deserve hearty congratulations upon their success.

It is stated that a similar method is to be adopted at the plant of the Transvaal Platinum, Ltd., in the Waterberg, where the crushing and treatment equipment of that company, which will have a capacity of 1000 tons per month, is now nearly completed. In the Waterberg equipment, chlorination will figure as an important integral factor in the recovery of platinoid, and it is quite likely that the chlorination process will also be employed at Onverwacht. It is evident that the recovery of 85 per cent. obtained must be improved upon. The high grade of the Onverwacht ore is shown by the official statement of the Transvaal Consolidated Land and Exploration Company, which states that from January 13th up to January 31st the pilot plant crushed 367 tons of dunite ore. The initial consignment to London, on February 12th, of 209 oz. of platinoid sponge, for refining and realisation, was 60 per cent. of the production, and is estimated to contain 156 oz. of platinum and allied metals. On this basis, the total output from the 367 tons would be about 260 oz. of platinum and allied metals, which at current prices represents a value of over £6000. The yield per ton of ore works out at 14·2 dwt., a splendid return, and one which no other of the known propositions now nearing production is likely to approach.

So far the details of the final operations in the recovery of the platinoid sponge from its containing ores have not been divulged, but it is believed they will shortly be made public. It can, however, be said with confidence that the little pilot plant is running very successfully, crushing about 30 tons a day; that no serious difficulties have been encountered; that all indications point to a relatively low working cost; and that developments to date indicate that in all probability a large platinum industry will be established.

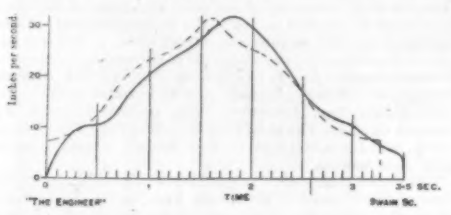
Other plants which will soon commence operations are two belonging to the Lydenburg Platinum Areas. One of them is on the company's Devars River farm. The plant there will consist of five heavy stamps—each of 2000 lb. weight—with ball mills and with the extraction plant supplied by Minerals Separation, Ltd. Provision is being made for rapid and substantial expansion of the equipment, and a high stamp duty is to be anticipated. It is expected that crushing operations will commence about the end of March or early in April. The other plant is on

the Maandagshoek farm of the company, but the work is not so far advanced as at Devars River, and it will probably not come into operation until May. This equipment will consist of Hadfield disc crushers, whilst treatment will probably follow the lines to be adopted at Devars River, *i.e.*, by means of minerals separation processes. The metallurgical policy of the Lydenburg Platinum Areas is, however, for the time being to retain an open mind with regard to treatment. In any process, the ore must first be crushed, and the Lydenburg Platinum Areas management is therefore going ahead with all speed in the direction of erecting equipment for that purpose. While the Minerals Separation, Ltd., process has yielded very satisfactory results from laboratory tests, the management will watch with keenest interest the results of tests and crushings in which methods different from those upon which the Devars River and Maandagshoek plants are being modelled are employed, and if considered advisable, the treatment scheme will be adapted to the most advantageous method. The plant at Maandagshoek will have a capacity of 70 tons a day, and will deal with the dunite ore from the Mooihoek and Driekop pipes. To transport the ore, two aerial ropeways, respectively 3 miles and 3¼ miles long, are being erected to these pipes, the plant being at the base of a wide V, formed by these transporters. The power requirements of the reduction works and of the two pipes are supplied by a four-cylinder gas engine direct coupled to a 360-kilowatt alternator, and operating on producer gas from semi-bituminous coal.

Plans for a pilot plant have been prepared for the Potgietersrust Platinum Company's mine, and it is expected that the company will be producing toward the end of April. The Johannesburg Consolidated Investment Company, that great financial institution with controlling interests in many of the great gold mines of the Rand, and in many other directions, has taken over the control of the Potgietersrust Platinum Company's affairs. Plans for the early erection of a pilot plant on the platinum-bearing farm, Forrest Hill, of the Transvaal Estates and Development Company, are receiving favourable consideration.

Institution of Mechanical Engineers.

At a meeting of the North-Western Branch of the Institution of Mechanical Engineers, held at the Engineers' Club, Manchester, on Thursday, 4th inst., Mr. W. A. Hanton read a paper on "Some Mechanisms of Textile Machinery." The subject is of such an extensive character that the author must have found much difficulty in making a selection of the appliances for description. He therefore picked out for consideration one or two important mechanisms the functions of which are comparatively easy to understand. Most of them, although long established and well tried, are, in one way or another, imperfect in their action, and some further study of them, the author said, might not be entirely wasted. The first appliance which came up for consideration was the flyer frame, and the author described the mechanism, which has become standard practice in these frames to produce the variations of speed of the bobbins by the use of tapered cones or by a friction pawl and disc drive. He said that although giving fairly good results when well looked after, the winding motion was not altogether satisfactory and efforts continued to be made to improve it. The cone drive was not very good—though probably preferable to the friction



disc drive—and none of the differentials gave entire satisfaction. That was probably due, in some measure, to faulty understanding of the mechanics of the motions, especially in connection with the effects of friction. It was generally supposed, for example, that rotating the part driven from the cones in the same direction as the main shaft, instead of in the opposite direction, resulted in a reduced load on the cone belt. That was only true when the speed of the part was less than that of the shaft. If it ran faster than the shaft, as frequently happened, near the start of the bobbin, it was just as hard on the cone belt as rotating the part in the opposite direction to the shaft, although the work wasted in friction and the wear were much less.

The best results from these motions appeared to be got from those in which the arm was fixed to the main shaft, so that the part driven by the cones was light and did not have much effect on winding, owing to its inertia. It seemed desirable to arrange that the part driven from the cones should always rotate more slowly than the main shaft, so as to relieve the cone belt as much as possible, though it was probable that the driving of the lifter rail was generally responsible for most of the pull on the cone belt.

The author then went on to describe the chief features of the mule, which embody some of the most interesting mechanisms in spinning machinery. Some diagrams of mule carriage motions were shown. Mr. Hanton said that although the scroll drive had much in its favour, it had disadvantages. It was silent and comparatively easy to adjust, but it was probable that the carriage movement obtained, especially at the start and atop, was not as smooth as it appeared to be, while the life of the driving bands was short. The starting radius of the scroll was considerable, and when the clutch was engaged the drawing-up bands applied as much force to the carriage as the clutch was capable of transmitting. This force suddenly applied to the carriage gave a somewhat erratic start up. It was probable that a movement akin to a simple harmonic for a half-period starting from one extreme position would be the most desirable movement, and that was not very different from that given by Dobson's scroll, which is reproduced in the accompanying diagram.

Dealing with weaving machinery, the author confined his remarks to problems of weft supply, which, he said, had exercised the ingenuity of loom makers and inventors ever since the introduction of power loom weaving, and had not yet been solved satisfactorily. The most interesting part of this section of the paper was that dealing with the Souczek loom, the shuttle of which uses some of its energy for compressing a spiral spring, which in turn helps to accelerate the shuttle when released. The author did not consider that the principle of accelerating the shuttle by means of rollers was satisfactory, as it wasted energy in friction. He admitted, however, that that type of loom eliminated noise and vibration.

INSTITUTION OF NAVAL ARCHITECTS.

The Spring Meetings of the Institution of Naval Architects will be held in the Lecture Hall of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2, on Wednesday, Thursday and Friday, March 24th, 25th and 26th. The annual dinner of the Institution will be held on Wednesday, March 24th, at 7.30 p.m., in the Grand Hall of the Connaught Rooms, Great Queen-street, W.C. 2.

For the meetings the following programme has been arranged:—On Wednesday, March 24th, the meeting will be opened at 11 a.m., when the Annual Report of the Council will be presented, and the election of the President, officers and Council for the year will be proceeded with. The Institution Premiums will then be presented, and the President, the Duke of Northumberland, will then deliver his opening address. Subsequently the following papers will be read and discussed:—(1) "The Present Outlook for British Shipbuilding," by Mr. A. C. F. Henderson; and (2) "Launching Arrangements of H.M.SS. Nelson and Rodney," by Mr. W. J. Berry.

On the Thursday the morning session will be opened at 11 o'clock, when the following papers will be taken:—(3) "Temperature Variation and Heat Stresses in Diesel Engines," by Mr. Robert Sulzer; and (4) "Comparative Freight Economics of a Cargo Vessel with Reciprocating and with Diesel Machinery," by Mr. W. J. Lovett. In the afternoon at 3 o'clock the following papers will be considered:—(5) "Propeller Dimension Formulæ based on Mr. R. E. Froude's Model Screw Experiments," by Professor C. M. Carter; and (6) "Some Experiments upon the Skin Friction of Smooth Surfaces," by Mr. W. G. A. Perring. The evening session will open at 8 o'clock, when the following papers will be taken:—(7) "Experiments on Mercantile Ship Models in Waves," by Mr. J. L. Kent; and (8) "Ship Wave Resistance: A Comparison of Mathematical Theory with Experimental Results," by Mr. W. C. S. Wigley.

On the Friday the morning session will open at 11 o'clock, and the first business will be the election of new members, associate members, associates and students, and the appointment of scrutineers for the next annual meeting. Mr. Harold E. Yarrow will then read a paper on (9) "High-pressure Water-tube Boilers for Marine Purposes," which will be followed by a paper, entitled (10) "Some Recent Modifications to Water-tube Boilers of the Three-drum Type fitted in H.M. Navy," by Engineer-Captain L. M. Hobbs, R.N. At the afternoon session at 3 o'clock, the first paper will be by Mr. A. W. Cluett, (11) "On the Method used in H.M. Ships for Readily Correcting Heel and Trim," and the second by Mr. Ebenezer Smith on (12) "Crane Equipment of Shipbuilding Berths." There will be no evening session.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

THE MEASUREMENT OF CUTTING TEMPERATURES.

Sir,—Mr. E. G. Herbert's attempt to measure cutting temperatures by means of the E.M.F. generated between the tool and the work is ingenious, but, in my opinion, inaccurate for the following reasons:—(1) The thermo-electric power of a metal is altered by strain, and the E.M.F. developed by a strained couple cannot therefore be assumed to be the same as that obtained with the unstrained materials. Mr. Herbert, however, takes for granted that the E.M.F. at the same temperature will be identical for both—an assumption which cannot be justified. (2) The E.M.F. produced by a junction of two metals varies considerably if the joint is not equally heated on both sides. If a piece of carbon tool steel be heated at one end and pressed on to a piece of mild steel, the free ends being connected to a galvanometer, a deflection will be noticed which falls off in value until the temperature becomes the same on both sides of the junction. The E.M.F. generated under a temperature gradient of this kind is frequently many times as great as the steady value obtained when the temperature is the same on both sides of the junction, as is the case during calibration. When a tool is cutting metal, equality of temperature in the tool and the work in the parts beyond the cutting edge appears to be impossible, as the thermal capacities and conductivities of the tool and the work are different, and the tool is continually advancing into colder metal. It is therefore fairly certain that the E.M.F. observed during cutting does not represent the same temperature as that deduced from the calibration curve.

The accurate measurement of temperatures by means of thermo-couples is not nearly so simple a matter as is often supposed, and freedom from strain and the absence of a temperature gradient at the junction are essential. It has recently been found that couples of the same materials inserted in an enclosure hot above and cool below do not register the same temperature when placed side by side, unless equal in diameter, although agreeing perfectly in a space evenly heated throughout. The thermo-electric method is only reliable under uniform conditions which certainly do not exist in Mr. Herbert's experiments. His results may be useful comparatively, but must be regarded as qualitative rather than quantitative.

Professor Coker's suggestion to place a suitable wire in the nose of the tool would enable information to be obtained as to the temperature of the tool at the point of insertion, but would still leave open the question of the temperature of the work.

London, S.E. 18, March 8th. Chas. R. Darling.

PETROL ENGINE CONVERSION.

Sir,—We read with considerable interest Mr. Patrick Gay's letter in your issue of the 26th ultimo, and note that he would be glad to hear of the experiences of those who have tried to substitute fuel oil for petroleum in a petrol engine. This has, of course, been attempted on very many occasions, and those experiments which have not resulted in serious trouble have certainly been both amusing and instructive, if of little practical value.

The standard horizontal gas engine, of course, offers a much more satisfactory basis on which to work than any high-speed petrol engine, but we quite agree with your correspondent that it certainly entails a heavy expenditure inasmuch as considerable alterations are necessary.

Our experience, embracing twenty-one years of manufacture and experiment with paraffin engines, confirms his statement that where petrol engines have been running on paraffin the results are far from satisfactory, and the fitting of a so-called paraffin vaporiser to an existing petrol engine is never a satisfactory job, as he states. This type of haphazard conversion, however, should not be confused with the production of a high-speed vertical paraffin engine with the vaporiser designed with and built into the plant.

In regard to converting a petrol engine of 220 brake horse-power, this we should look upon as almost hopeless. In the first place, the engine in question is very much too light and of too high a speed to use a heavy oil, and the percentage loss of power suggested, namely, 15 per cent., is much too optimistic, and 40 per cent. would probably be nearer the mark, if it were possible to vaporise the fuel at all.

Another point which Mr. Gay raises is of some interest, namely, that fuel oil contains a certain percentage of tar; but we venture to disagree with him as to its suitability as a lubricant for high-speed petrol engines.

The above few remarks, dictated in the light of over twenty years' manufacturing and experimental experience, may be of some interest. The Parsons Motor Company, Ltd.

Southampton, March 5th.

THE TRAINING OF ENGINEERS.

Sir,—I have read with interest the correspondence that has been published in your recent issues on the question of the training of engineers and the value of a classical education, and the study of Latin and Greek in particular.

It would appear that there is a slight tendency to confuse the general education of the engineer as a cultured and intellectually active man with the specialised technical training necessary to enable him to take his place in the ranks of our profession. The two educational fields differ immensely in scope and relative value.

Culture, or the highest degree of general education, should be aspired to by all engineers who desire to gain eminence in their profession, to move in the most polished and intellectual society, and to make the greatest possible use, to themselves and to mankind, of their professional activities. Literature, philosophy, sociology, and, in some proportion, all the arts and sciences, have their place in the studies of the engineer of culture.

Whilst this broad knowledge may be essential to the engineer of eminence, without the specialised technical training for his profession no man can be in name or deed an engineer at all; so that it should be obvious that the acquisition of an infinitesimal degree of "culture" at the price of neglect of the technical training of the engineer is wrong.

To become practical and successful engineers, it is necessary for youths to have completed their full-time schooling by the time they are sixteen or seventeen, and commence their apprenticeship or practical training. The amount of Latin and Greek that can be acquired up to that age, if the essential mathematical and scientific studies are not to be neglected, is too small to confer any real tangible advantage, such as an ability to read and appreciate the classic Greek and Latin works; the time that has been devoted to the study of these dead languages is therefore practically time wasted. The culture which a knowledge of these works may confer is to be much more readily and pleasantly acquired by a study of the excellent translations that now exist; such, for example, as Professor Gilbert Murray's English versions of the Athenian Drama. Moreover, it should not be overlooked that to the boy of a mechanical and scientific bent the study of the dead languages is generally distasteful.

March 8th. R. Opie.

[We trust our correspondents will not lay too much stress on the question of dead languages. There are classics in the live languages also, and it is to them that attention should be given.—Ed. The E.]

THE COMMERCIAL AIRSHIP.

Sir,—I am afraid I must entirely disagree with Mr. Wallis' remarks *re* corrosion of Duralumin at the faying surfaces, mentioned by him in his paper on "The Technical Aspects of the Commercial Airship," published in your issue of February 19th.

The very contrary has occurred in actual practice. With thin-gauge material it is not possible to obtain a real metal-to-metal contact, with the result that corrosive fluids will lodge in the crevices—such places are overlooked by inspectors. Unfortunately, in most cases they are impossible to detect, unless the joint is dismantled. The question of varnishing these surfaces has often been discussed, but this method of protection is not desirable, as it would reduce bonding efficiency if non-conductive coatings were used. Intercrystalline corrosion of Duralumin is not always dependent on surface corrosion, but will depend largely on the impurities existent in the material; if impurities are in existence, then surface attack will undoubtedly intensify intercrystalline attack. Duralumin cold worked or worked after final heat treatment is much more readily attacked by intercrystalline corrosion.

Mr. Wallis' method of detecting intercrystalline corrosion is sound, and has often been tried. Minute cracks at the bend will appear in material thus attacked. Duralumin should never be rolled or bent with too sharp a radius, as this results in too severe local stretching at the bend, probably producing embrittling and corrosive attack.

Bedford, March 5th. S. H. Phillips.

Railway Matters.

THE annual report of the Great Northern Railway of Ireland states that in view of the decline in traffic the renewal of 250 wagons will not be proceeded with and £24,300, representing their original cost, has been credited to capital account.

ADDRESSING the shareholders of the London, Midland and Scottish Railway on February 26th, the chairman said, in answer to a question, that he had carefully omitted to say anything about motor traffic. His abstention was due to the Railway Companies' Association having taken the matter up with the Government, and he thought it would be inopportune to say anything about it at that time.

THE opening of the Watford line and the consequent increase in the number of trains on the Metropolitan Railway led to some little disorganisation in the services. During the month of January the number of trains on the Aylesbury extension line that were on time or not more than two minutes late was 89·8 per cent. During the first part of February the number had, however, risen to 92 per cent.

THE locomotive fuel bill for the London, Midland and Scottish Railway was £5,928,980 last year, as against £6,438,440 in 1924. The total engine miles run were 230,970,800, as compared with 231,310,904. Commenting on this fact, the chairman of the company at the annual meeting on February 26th said that £417,000 was saved by less cost per ton for the coal and by a decreased consumption per engine mile, viz., 57·40 lb. per engine mile, as compared with 58·12 lb. in 1924.

DURING the first six months of last year seventy-seven inquiries were conducted by the Ministry of Transport into accidents to railway servants. Certain of them related to fatal cases which had resulted in the death of twenty-five men. The causes assigned were:—Want of care on the part of the deceased, fifteen; misadventure, five; want of care on the part of a fellow servant, one; momentary forgetfulness, one; look-out protection insufficient, one; no look-out protection provided, one; unknown cause, one.

BRITISH railways differ from those in the United States, in that the former charge "betterments" to capital. Thus the London and North-Eastern charges to capital the provision of the vacuum brake to the engines that hitherto have had the Westinghouse, also the provision of steam heating apparatus to its carriage stock. It is true that these are additions and that capital has not paid for them, but they help to swell the capital account of the company. More noteworthy still is the charge to capital by the London, Midland and Scottish of £5695 for improvements of locomotive stock, £632,922 for improvement of carriage stock, and £1,031,411 for improvement of wagons.

A SURVEY of the proposed railway from Pingtichuan to Pangkiang has been completed by the special survey corps of the Peking–Suiyuan Railway. When constructed, the line will be a branch of the Peking–Suiyuan Railway, the junction being Pingtichuan Station. It will also serve as the beginning of a line to Urga. The whole distance, as surveyed, is 242 kiloms., and is in two sections, one from Pingtichuan to Tumutai, of 114 kiloms., and the second from Tumutai to Pangkiang, of 128 kiloms. The first section will involve the construction of bridges at Pawangho, Kweilamaho, and Alashankow, and includes very steep grading along the hill slopes near Taliuhaochun, where the road bed can be laid only by excavating into the stony hills. After that, the line traverses flat country around Taolinhsien, where land is being reclaimed for cultivation. The second section has practically no steep slopes to climb, the steepest gradient being 1 in 100. At Hungshan it cuts across the motor road from Kalgan to Urga. The total cost of construction is estimated at 11,000,000 dollars.

OF the 20,328 miles 48 chains of railway in Great Britain 1252 miles 36 chains are jointly owned by two of the grouped companies. The outstanding examples of joint ownership are the Midland and Great Northern with 194 miles 31 chains; the Cheshire Lines with 143 miles 17 chains; and the Somerset Joint Committee with 105 miles 45 chains. Smaller lines are the Great Central and Midland, 39 miles 23 chains; the Great Central and North Staffordshire, 10 miles 77 chains; the Great Western and Great Central, 41 miles 13 chains; the Great Western and Midland, 41 miles 8 chains; the Metropolitan and Great Central, 51 miles 57 chains; Norfolk and Suffolk, 22 miles 22 chains; the South Yorkshire, 20 miles 33 chains. Other lines are the Birkenhead, Shrewsbury and Hereford, Dundee and Arbroath, Swinton and Knottingley, West London and Tottenham and Hampstead. Besides these there are jointly-owned stations, *e.g.*, Aberdeen, Perth, Worcester, Bristol, and North-road, Plymouth. Asked on February 8th whether he intended to take any steps to encourage the entry of joint lines into their appropriate groups, the Minister of Transport replied that it was not considered generally practicable in the Railways Act, 1921.

AT the Institution of Railway Signal Engineers on Wednesday evening, March 3rd, Mr. W. J. Thorrowgood, the signal and telegraph superintendent of the Southern Railway, gave some particulars of the four-aspect colour light signals which are being installed on that company's lines in the London area. To appreciate why a fourth aspect is necessary it may be explained that in three-position or three-aspect signalling the second indication—given by a yellow light—intimates that the next signal in advance is at "danger." But since the latter signal may be less than braking distance away, *i.e.*, too near for the train to be pulled up in the distance, Mr. Thorrowgood has provided a fourth indication, which is given by a double yellow light. It is known as a "warning" signal, and it is always full braking distance in the rear of a red—"stop"—signal. If there be any signal between the "warning" and the "stop," it will display one yellow light and indicate "caution." At junctions there will be only one four-aspect signal, but an illuminated route indicator will be provided for advising a driver the direction for which the road is made. The class of light signal known as a fog repeater will bear the illuminated sign F. Some of the new signals are to be brought into use on March 21st.

Notes and Memoranda.

TENDERS for the overhead equipment required in the electrification of the Capetown suburban railways should be in by April 12th.

ACCORDING to the *South African Mining and Engineering Journal*, the first output of platinum in South Africa was produced at the Onverwacht Mine early in February. About 20 oz. of metal containing 85 per cent. platinoid were recovered in fifteen days.

THE world's production of linseed during last year is reported to have been 89,739 thousand centals, while the probable production this year, it is forecasted by the International Institute of Agriculture, will be even greater. The average crop within recent times has been 59,948 thousand centals.

ONE of the latest bulletins issued by the United States Department of Commerce deals with the sampling and examination of mine gases. It includes over a hundred pages, and contains a great fund of useful information. The price is 25 cents, and it can be obtained from the Government Printing Office, Washington.

IN the course of a discussion at a meeting of the Oil and Colour Chemists' Association, concerning methods of grinding, Professor J. W. Hinchley said that it was quite possible, with the recent invention of anti-corrosive steel, which provided great density and hardness of surface and lack of corrosion, it would be feasible to make use of crushing methods for the very fine work of pigment grinding in large quantities.

ACCORDING to the *Times*, Dr. B. S. Hopkins, Professor of Inorganic Chemistry, University of Illinois, claims, with his assistants, to have isolated from rare earths one of the five elements whose places in the scale of atomic members had not, up to the present, been filled. Its place is the sixty-first in the scale. The discovery is the result of more than five years of elaborate researches with specially constructed X-ray apparatus.

WRITING to the *Canadian Engineer* Mr. F. Nagler, of the Allis-Chalmers Company, says that hydraulic "turbine governing seems to the writer to have less and less application to commercial practice, even so far as the guide vanes alone are concerned. That the general tendency is towards the elimination of governors is evidenced by the increasing number of turbines that go in without them. To apply governors still further to turbine practice is contrary to the general tendency, even though equivalent and equally reliable mechanical construction could be obtained."

COMMENTING on the explosion of a cast iron stop valve chest in a Fleetwood factory, the Engineer Surveyor-in-Chief, Board of Trade, remarks that the cast iron valve chest was generally of rather light construction, and weakness at the inlet branch was accentuated by the irregular thickness of the metal. The owners have wisely replaced the chest which failed by one made of cast steel. The automatic closing of the emergency self-closing valves which were fitted to four of the boilers illustrates the special advantage of these fittings, when there are more boilers than one connected together.

CERTAIN chemical tests for the extraction of power alcohol from prickly pear under the formula of a southern investigator are, according to the *Industrial Australian*, being carried out in Brisbane under the supervision of the Queensland Government Analyst and the Government Agricultural Chemist, but have not yet reached finality. It is understood that the inventor claims that a certain percentage of sugar and 2 per cent. alcohol, or 5 per cent. alcohol taking it by dehydration, can be obtained from the prickly pear. The manufacture of power alcohol from cassava on a commercial scale is being started at Sarnia, North Queensland.

A NOVEL structural feature introduced in the electrification of the Detroit, Toledo and Ironton Railroad at Detroit, Mich., is the use of reinforced concrete arched bridges or spans to carry the overhead wires, these taking the place of the usual structural steel bridges or steel poles. The arch spans are, says the *Engineering News-Record*, built of precast concrete members of H-section. For the normal double-track spans there are two side columns and two arch segments, with a spacing of 33ft. c. to c. of columns and a height of 34ft. above top of rail. Where additional tracks require longer spans, a horizontal spreader beam is placed between the arch segments. The arches are spaced about 300ft. apart.

IN the course of a survey of the economic and commercial conditions in Morocco by H.M. Consul-General at Rabat and H.M. Consul at Casablanca, it is pointed out that the trunk road from Fez to Marrakesh still awaits completion. This is the principal road needed to complete the extensive system of roads, connecting all important points in the pacified portions of the French Zone, to which a substantial portion of the loans contracted since 1914 has been devoted. The whole system will comprise about km. 3400 of first-class roads and km. 750 of second-class roads, in addition to a considerable number of *pistes aménagées*, which, though not classed as roads, are in some cases adequate to carry ordinary motor traffic. The system of roads links up with that of Algeria and Tunisia, so that there is direct communication by road between Casablanca and Tunis *vid* Oran and Algiers.

IN its report, presented to the Brisbane City Council recently, the Cross-River Commission recommends, amongst other proposals, a two-deck continuous girder bridge, connecting North Brisbane with Kangaroo Point, and also a shipping canal through Kangaroo Point. The virtual cost of construction of the project is estimated at £1,510,000. The Commission recommends that:—(*a*) A two-deck continuous girder bridge be built, the upper deck taking off at Petrie Bight, the lower deck from Adelaide-street, and crossing the river 10ft. above the highest flood level to a point in Main-street, each deck to be 40ft. wide between kerbs, and to have cantilever footways 7ft. wide; and that (*b*) a shipping canal, 150ft. wide and 35ft. deep, with 20ft. roadways on each side, be cut through Kangaroo Point, and crossed by a single deck 190ft. span bascule bridge at the existing ground level, the bridge to have a width of 80ft. between kerbs, and cantilever footpaths 12ft. wide.

Miscellanea.

THE British Chemical Plant Exhibition, 1926, will be held at the Central Hall, Westminster, from July 19th to July 24th, inclusive.

THE first steel rolled in Australia for the Sydney Harbour Bridge was rolled late in January at the Newcastle works of the Broken Hill Proprietary Company.

IT is stated that there is a possibility of the coke ovens at the Priestman Collieries at Blaydon Burn being restarted, and also the erection of a coke crusher on the site of the old beehive ovens.

A STEAMSHIP service from Vancouver to Argentina, *vid* the Strait of Magellan, will be inaugurated this month by the General Steamship Corporation. Five large freighters will be placed in service.

THE output of coal from the mines of Great Britain during the week which ended on February 27th was 5,371,700 tons, as compared with 5,270,700 tons for the corresponding week of last year.

UNDER the chairmanship of Mr. W. J. Brooke, of John Lysaght, a committee is organising research into blast-furnace fuels to be carried out at Sheffield University under the direction of Professor C. H. Desch and Professor R. V. Wheeler.

IT is announced that Messrs. Cox and Danks, Ltd., have just raised at Scapa Flow the B III., the fourth of the larger type of German destroyers sunk there. The vessel, which was found lying on its side, was of approximately 1300 tons. It is the twenty-second destroyer to be raised.

EXTRACTION of oil from Tasmanian shale on a commercial scale will probably be started by the Australian Oil Corporation at its Latrobe works this month. It is reported that the Bronder retort is proving successful, though some trouble had been experienced owing to the bitumen contents of the shale. This difficulty, however, is now stated to have been overcome. The capacity of the retorts is 160 tons a day each.

THE Chinese Eastern Railway, it is reported, has decided to establish thirteen electric light stations in thirteen different towns on its route. The programme covers three years. In the first year two plants at Anta and Suifeng will be set up, the remainder to be established in the following two years. The cost of the entire scheme is estimated at 469,000 dollars. The plants will supply current to private subscribers as well as the railway staff.

SUBJECT to the approval of the Imperial Colony Crown Agents, the Government of Grenada, one of the Windward Islands group, will shortly enter into a contract for the erection of a hydro-electric plant at Grand Etang in the interior of the island. It is proposed by means of the water power available to generate current for lighting St. George's. At the same time a contract will be concluded for the extension of the water supply system, the improvement of the main highways, and a number of other public enterprises.

FIVE motor roads have been opened to traffic in the North-West of China, and three are planned or under construction. Those which have been opened to traffic are:—(1) Kalgan–Urga road, 800 miles; (2) Kalgan–Dolonor, 200 miles; (3) Paotowchen–Ningsia, 400 miles; (4) Kalgan–Pingtichuan, 170 miles; and (5) Kalgan–Bangkiang, about 250 miles. Those planned or under construction are:—(1) Lanchow–Ningsia, about 200 miles; (2) Lanchow extension, about 500 miles; and (3) Kalgan–Jehol, mileage not known.

THE Municipality of Valparaiso is considering a project for a new water supply system, which will also include plans for a hydro-electric plant to furnish light and power to the towns along the route of an aqueduct leading from the Andean Mountains to the city. The length of the aqueduct will be 125 miles, and its capacity between 180,000 and 200,000 cubic metres of water a day. Several favourable sites for the erection of the hydro-electric generating stations have been found. The available head of water is given as being more than 5000ft.

IN order to cope with the further demands made by tube extensions, the generating plant at the Lots-road power station is being augmented. A fourth 15,000-kilowatt machine is under construction, and when this is complete the generating capacity of the station will be 102,000 kilowatts, or about 137,000 horse-power. In addition, two further boilers, having a capacity of about 50,000 lb. per hour, are under construction for the steam generating plant, which already comprises sixty-four boilers, and these will be in operation during the present year.

THE Victorian Electricity Commission, which is gradually supplying the whole of the State with electric energy, recently completed the first portion of one of the biggest engineering works of the kind ever carried out in the British Empire, when the first two cables of the Sugarloaf Dam span were carried across a deep gully and creek and strained into position. In the Sugarloaf Rubicon hydro-electric scheme it was necessary to carry the main transmission line, which will eventually carry a current of 66,000 volts, from Sugarloaf Hill to the foothills on the other side of the weir. The shortest distance possible between the supports on either side was found to be 4726ft., and after overcoming numerous difficulties the work was successfully completed.

THE New Zealand Government's refusal to sanction the use of the Milford Sound Waterfalls for power for nitrate production has, says the *Industrial Australian*, caused disappointment, but there is compensating ground for hope furnished in the report by the Public Works Department, which is investigating the power possibilities of other places in the Sounds district, which would not entail interference with the scenic beauties. The possibilities of tapping Lake Manapouri or Te Anau, and carrying the water to one or other of the lesser Sounds, will be thoroughly prospected. The exploration work is not in the interests of any projected enterprise, but to furnish data showing whether or not the Sounds district is available as a source of power for future commercial schemes requiring unlimited power supplies.

AN ELECTRICALLY-DRIVEN BAKERY IN EDINBURGH

(*For description see page 294*)

FIG. 5—DIVIDER, HANDER-UP, PROVER AND MOULDING MACHINE

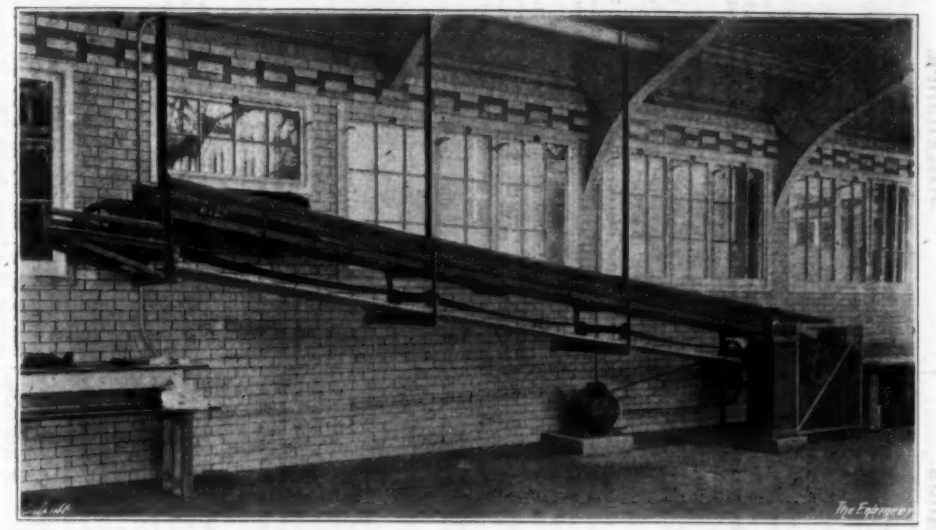


FIG. 6—BREAD CONVEYOR ENTERING COOLING AND DISPATCH HALL

FIG. 7—BLENDING HOPPERS AND BUCKET CONVEYORS

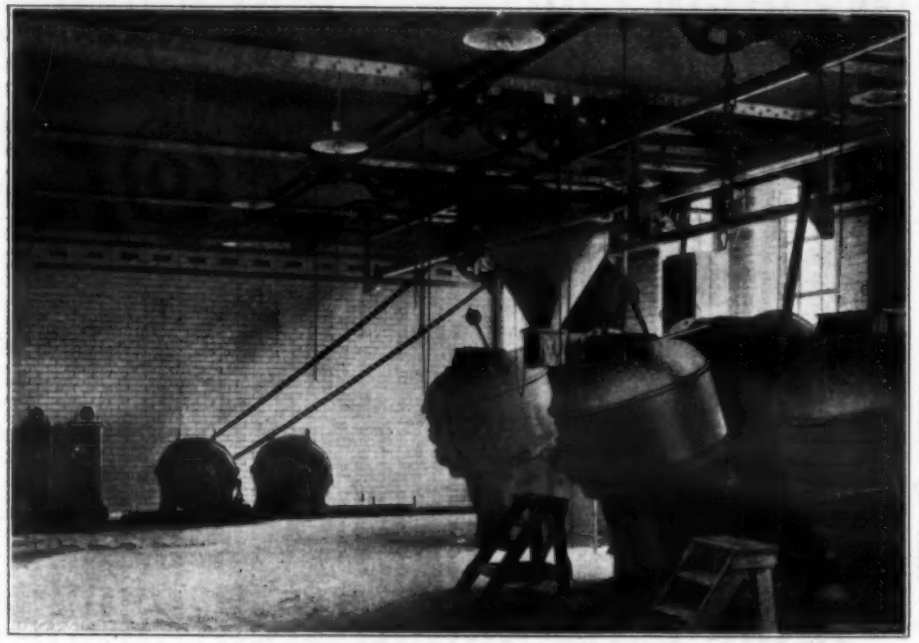


FIG. 8—SERIES OF THREE-SACK KNEADERS

AGENTS ABROAD FOR THE SALE OF

The Engineer

BUENOS AIRES.—MITCHELL'S BOOK STORE, 576, Cangallo.
CHINA.—KELLY AND WALSH, Limited, Shanghai and Hong Kong.
EGYPT.—CAIRO EXPRESS AGENCY, near Shepheard's Hotel, Cairo.
FRANCE.—BOYVEAU AND CHEVILLET, Rue de la Banque, Paris. CHAPELOT AND CIE., 136, Bld. St. Germain, Paris.
BELGIUM.—W. H. SMITH AND SON, 78/80, Rue du Marché-aux-Herbes, Bruxelles, and 44, Rue Joseph II., Ostend.
INDIA.—A. I. COMBRIDGE AND CO., Bombay; THACKER AND CO., Limited, Bombay; THACKER, SPINK AND CO., Calcutta.
ITALY.—MAGLIONI AND STRINI, 307, Corso, Rome; FRATELLI TREVES, Corso Umbarto I, 174, Rome; FRATELLI BOCCA, Rome; ULRICO HOEPLI, Milan.
JAPAN.—MARUZEN CO., Tokyo and Yokohama.
AFRICA.—WM. DAWSON AND SONS, Limited, 7, Sea-street (Box 49), Capetown.
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THE ENGINEER.

MARCH 12, 1926.

The "Black Spot."

THE anxiety with which engineers from one end of the country to the other are watching the progress of those critical events which are centred about Hoe's works cannot be exaggerated. After many months of deep depression they saw signs of a better future, the period of stagnation which, it appears, commonly follows great wars was coming to an end, and the period of prosperity which, equally, is part of the economic routine after an international struggle was in sight. At that very moment, when a united effort of employers and employed would assuredly have lifted the engineering industry out of the trough into which it had fallen, a section of labour passed the "Black Spot" upon their employers. To understand their action it is necessary to recall a few of the leading facts.

During practically the whole of last year the engineering trades unions debated with the Employers' Federation the possibility of increasing the rate of pay by twenty shillings a week. The employers did not deny that, by comparison with other trades, the "engineers" are ill paid; but they were able to show that the condition of industry was such that if the claim for another pound a week were persisted in complete collapse would result. At the last meeting of the unions with the employers, the unions, when they saw that a national agreement was out of the question, said they would press for district agreements, to which the employers replied that they would hold together, and that they would institute a general lock-out in the event of sectional strikes. In 1922 an agreement between the Federation and the unions was signed at York. It contains clauses which are generally known as the Provisions for Preventing Stoppages of Work. The mechanism is of the usual kind in such cases; it prescribes the successive stages through which a dispute must go before it can culminate in a strike or lock-out. There is no question that the men at Hoe's works broke this agreement, although they are endeavouring to saddle the employers with the responsibility and are calling the stoppage a lock-out. What happened was that six weeks ago the men started a "stay-in strike," professedly against the employment of non-union men, but equally, at least, for increased pay; that is to say, they clocked-on, but once inside the factory did no work. Very naturally the management posted a notice to the effect that the works would be closed to all men who behaved in that way, but, it added, they would be open to all who chose to work. It needs a very ingenious imagination indeed to see in this common-sense action a "lock-out." The executives of the seven trades unions involved took this view, and advised the men to return to work. They, clearly, regarded the outbreak as a strike in contravention of the 1922 agreement, and, it is said, refused to give strike pay. The men remained recalcitrant, and the employers promptly took a step which they were fully justified in taking. They proclaimed that, if the men did not immediately return to work, national lock-out notices would be posted on Friday, March 5th, to take effect on the following Friday. The proclamation had not the desired effect, and the lock-out notices were duly posted throughout the country on Friday last. The wisdom of this firm and prompt action cannot be challenged. In the first place, it supported the unions which were struggling with rebellious members who admittedly had broken a solemn pledge, and in the second, it showed the men that the employers are solid in their determination that negotiations shall be conducted on constitutional lines. We do not suppose that the action had any effect upon the executives themselves, for we may even suspect that they were direct parties to it; but it is not improbable that it awoke the strikers to the folly of their course and the consequences it involved. Yet they still protested their intention to remain out until their claims were satisfied. Their obstinacy gave concern to the executives, who, after a meeting on March 5th, adopted a resolution that they should go back to work; as the men did not return, a further meeting of the executives was held on Tuesday last, when six out of the seven unions concerned endorsed this resolution, the Electrical Trades Union alone objecting, and on Wednesday last at a mass meeting with Hoe's workers in the Memorial Hall, Farringdon-street, the resolution was laid before the men and the consequences of a refusal to obey made clear to them; but they still refused to conform to the instructions given. Unfortunately, the unions were not in a position to enforce, at once, their orders. Six of them—for the E.T.U. had now joined forces with the others—could do so, but the A.E.U., to which the bulk of the men belong, desired to consult its National Committee. That Committee could not meet before Saturday, March 13th, and Sir Allan Smith, when requested to do so, agreed to postpone the lock-out notices for a week. What action the unions as a whole will decide to take cannot be known for a few days, but in view of coming events, it may safely be anticipated that they will insist upon constitutional action.

We have outlined the history of the successive moves in order to bring out as clearly as possible certain essential facts. The first and most important of these facts is the admission of the trades unions involved—or, at any rate, of six of them—that the strike is illegal in the sense that it contravenes an agreement. The second fact is that the employers showed a united front by proclaiming a national lock-out. Both these actions show as clearly as may be desired that whatever steps are to be taken with regard to an increase of "engineers'" rates of wages, they will follow constitutional lines. Hoe's men will probably go back to work under the pressure of the unions, but it must not be imagined that the matter will then be at an end. Everyone knows that in a short time the question of wages will be up for consideration once more on a national basis, and the attitude of the unions in dealing with the recalcitrants is inspired in part by the embarrassment their action has caused at the very moment when a new campaign is in preparation. What is to be the outcome it is impossible to foresee. The unions will press for a national agreement to increase wages; the employers will have no course in present circumstances but to refuse it; the unions may then say they will seek district increases by means of strikes, and the employers may threaten a national lock-out if any such course is taken. Some men would gladly tear up the 1922 agreement, so that the old heterogeneity might be revived, and others again are disposed to say, "If the industry cannot pay, then the State must, as it has done in the case of the mines." The position, it will be seen, is even now, one of the greatest delicacy. A false step may precipitate the engineering industries back into the depths. That we sympathise with "engineers" in their low rates we need not say; but low rates do not necessarily mean low wages; they may yet take home full envelopes and help the industry along its upward grade if they will but throw themselves into their work. The way to gain the end they have in view is to improve the state of the

industry; the sure way to lose it is to check the industry by disputes just when a happier prospect is opening before it.

The Design of Air Heaters.

WHENEVER a discussion takes place on the use of heated air for boiler furnaces it always seems to turn either on the question of the extra efficiency obtainable or on that of the durability of the grates and furnaces under heated air conditions. That the air heaters themselves will be satisfactory is taken for granted. This confidence is certainly a compliment to the makers of such apparatus, but unless it is justified by practical experience and based on a proper appreciation of what an air heater ought to be and to do it does not carry much weight. There are several competitive types of air heater on the market, differing widely in design. It may seem a very simple thing to heat air, and, given sufficient space and money, no doubt it is. But to heat it by means of the flue gases under the conditions which exist in a boiler-house, and above all to get an arrangement combining efficiency, compactness and reliability is by no means easy. So far as merely making the air hot enough is concerned all present requirements can be met. A plant has been working for a couple of years or so in a London power station delivering air to the furnaces at a temperature of 470 deg. Fah. and reducing the flue gases to a temperature of about 250 deg. Fah. Most engineers would be quite satisfied to stop at these temperatures, but any one desirous of surpassing them could certainly obtain plant which would realise his ambitions. The limit to the possible air temperature, assuming that the grates and furnaces can be designed to stand it, is, of course, that of the flue gases leaving the boiler. This, in an efficient plant, is generally well below 600 deg. Fah., and for a perfectly clean boiler worked at a moderate rating, it may be not more than 550 deg. Fah., even if a boiler pressure of 350 lb. per square inch be used. The temperature to which it is possible to reduce the flue gases is theoretically very nearly that of the atmosphere, but since the dew-point of the gases is probably about 110 deg. Fah. owing to the water vapour produced by the hydrogen and moisture in the fuel, it is unlikely that anyone would care to design for a lower temperature than 125 deg., even if cost were no consideration. Exit flue-gas temperatures as low as 160 deg. Fah. have already been recorded on official tests, so that both as regards its upper and lower limits of working temperature, the air heater of the future will have to meet conditions very different from those obtaining to-day.

Theoretical considerations and practical results both indicate that air heating will become the standard practice for all important boiler plants in the future, and that being the case, it certainly behoves engineers to give attention to the best means of transmitting heat from the flue gases to the air. Two rival principles hold the field at present, one depending on the transmission of the heat through a metal wall, and the other based on the plan of bringing a heat-absorbing surface alternately into contact with the flue gases and with the entering air. Each idea is embodied in various forms, and every form has its advocates. We have no intention of judging between them, our object being merely to call attention to the general problem, and to urge its importance. The designer has much more to do than simply to provide means for getting the air hot and the flue gases cool. The flue gases usually emerge from a power station boiler through a comparatively long and narrow opening in the top of the boiler casing, and have often to pass through an induced draught fan on their way to a circular steel stack. The flue work required for this arrangement is awkward enough, but when an air heater with a heating surface often greater than that of the boiler itself has to be got into the circuit, and combined with a forced draught fan and ducts, bringing the heated air to the grates, the design is one to tax the abilities of even the most competent draughtsman. The whole plant consisting of heater, fans and ducts is really a unit in itself, which has to be suitably connected to the boiler top, the grates, and the chimney stack. The position of the latter may be arranged to suit the heater, but no such convenience exists with regard to the boiler exit or the grates. If the heaters were not of such enormous size the problem would be simplified. At Barton an air-heating surface of 12,000 square feet is provided for a boiler with 16,000 square feet of heating surface, in addition to the economiser, and even then the air only enters the furnaces at 185 deg. Fah., according to figures given by Mr. Pearce before the Institution of Civil Engineers. When heaters are constructed of boiler tubes, as they very frequently are, an air heater with its ducts has almost the dimensions of another boiler, and to find room for it, and especially to provide convenient air and gas ducts, is no easy matter. The size can only be reduced either by increasing the gas and air velocities, or by increasing the rate of heat transmission per square foot, two changes which are interconnected with each other. Little information has been published about the present rate of heat transmission in air heaters, but it rarely exceeds 1000 B.Th.U. per square foot per hour and is often below 400 B.Th.U. A heat transmission of from 3 to 4 B.Th.U. per square foot per hour per degree Fah. may probably be taken as representing good modern practice. This figure checks fairly well with the heat transmission in an economiser, which working with temperatures of the same order, will hardly transfer more than 4 to 5 B.Th.U. per square foot per hour per degree difference of mean temperature, even when clean and with a good draught.

The efficiency of all air heaters which depend for their action upon the conduction of heat through metal depends enormously upon keeping the metal clean. The passages traversed by the air have little tendency to become dirty, and if the flue gases were always what they should be, the same remark would apply to the gas passages. But under modern conditions of draught a surprising amount of flue dust, to say nothing of unburnt particles of coal is carried through the boiler and will lodge in an air heater or anywhere else if it gets a chance. The common practice of making the gas passages straight and vertical mitigates the trouble from flue dust, but nothing, so far, seems able to prevent sticky deposits of tarry substances from fouling the surfaces sufficiently to constitute a serious hindrance to heat transmission. Air heaters do not lend themselves to a system of mechanical scrapers, like those used on vertical-tube economisers, for even when vertical tubes are used it is the practice to pass the hot gases through them, rather than round them. Water jets, steam jets and air jets have all been tried for the purpose of cleaning, but dirt still remains one of the chief sources of trouble. There is always the possibility that furnace conditions may arise which will result in unburnt hydrocarbons and tarry matters being present in the gases which will tend to be deposited on any relatively cool surface with which the gases come into contact. Furthermore, if the entering air is ever cold enough to keep any part of the heater at a temperature below the dew point of the gases, some of their moisture will be condensed on the walls of the heater, and rapid corrosion will take place exactly as in the case of an economiser fed with cold water. Troubles like this are almost outside the powers of the designer to avoid. All that he can do is to provide apparatus which is not unduly subject to corrosion or fouling, and which is as easy as possible to inspect and clean. The rest lies with the operating engineer. But that air heaters, in general, have yet received the consideration due to their importance we do not believe. They are among the most recent developments in boiler-house practice, and have hitherto been regarded rather as accessories to be added where possible than as essential parts of a complete plant, deserving as much attention as any other component. Even if investigation should show it to be impracticable greatly to reduce their size for a given duty, it is quite certain that there is much room yet for improvement in other directions. The question of cleaning, especially when smoky coal is used, is by no means satisfactorily settled, and designers also might well pay more attention to the broader question of producing an air heater which involves a less awkward arrangement of gas and air ducts than generally seems to be required.

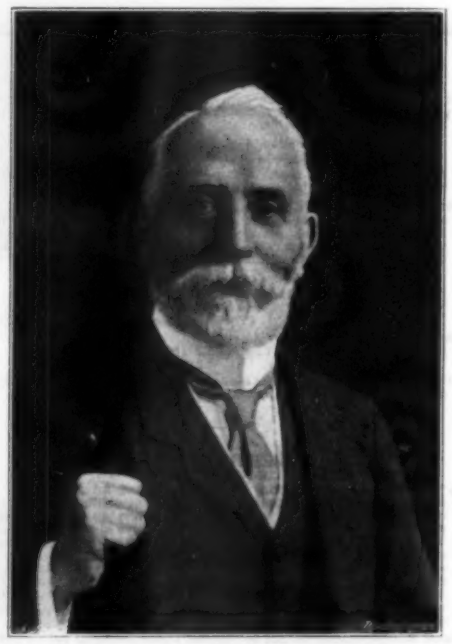
Obituary.

ALEXANDER MONTGOMERY CARLISLE.

THE death of the Right Hon. Alexander Montgomery Carlisle took place suddenly in London on Friday last, March 5th. It is said to have been the ultimate result of a visit paid the Ex-Kaiser at Doorn in November of last year, when he contracted a chill. The immediate cause, however, was heart failure.

Mr. Carlisle, who was both cousin and brother-in-law of the late Lord Pirrie—Viscountess Pirrie being his sister—was the eldest son of the late Mr. John Carlisle, who was, between 1861 and 1884, headmaster of the English Department of the Royal Academical Institution at Belfast. He was born at Ballymena, in County Antrim, on July 8th, 1854, and received his education at the Academical Institution under his father. In 1870, at the early age of sixteen, he was apprenticed at the shipbuilding works of Harland and Wolff, at Queen's Island, Belfast, with which company he continued to be connected for a period of no less than forty years—in fact, for the whole of his professional career. It is noteworthy that serving his apprenticeship at the same time was his cousin, who was to become Lord Pirrie. The latter, writing to a friend many years later, said of his relation—we quote from the *Belfast Telegraph*—"He came here (to Queen's Island) straight from the Royal Academical Institution, and his term of apprenticeship was distinguished by his great application to work and the fact that he never lost a single quarter day during the whole of the time, in recognition of which fact the firm presented him with a gold watch. After completing his apprenticeship he very shortly became the head of the drawing-office, or, to describe his position more clearly, chief confidential naval architect; and very soon his thorough mastery of work and management of men and many other sterling qualities were so evident that he became general manager, and to his great success in that capacity, no doubt, the growth and present state of perfection of the shipyard are no doubt largely due."

Those few words give a striking summary and the keynote of a life of strenuous work. He served his apprenticeship under the eye of the late Sir Edward Harland, himself a man of outstanding ability, capable of daring initiative, and possessed of keen observational powers, who saw to it that not only did the lads under him work steadily, but also that they learned their profession. To that end he helped and encouraged them in every possible way. From six o'clock in the morning till 5.30 in the evening were their hours and, as has been seen, young Carlisle never even "lost a quarter" during the period of his apprenticeship. Long before his time was up he had attracted attention alike for his intelligence and for his assiduity. He had, in fact, imbibed and assimilated many of the characteristics of his distinguished chief, and he was already marked out for promotion. It was only two years after his apprenticeship was over that he was made chief draughtsman. Thereafter his rise was rapid, and while still a very young man, he became, first, manager and shortly afterwards managing director of a shipbuilding company the fame of which is world-wide, and finally chairman of the Board of Directors. Actually, after Lord Pirrie, it might be said that he *was* Harland and Wolff. His rule was autocratic. Nothing was allowed to go on in the shipyard without his first having sanctioned it. His word had to be regarded as law, and he took care to see that it was. At the same time he was not only respected but regarded with considerable affection, both by the staff and by the whole body of workpeople, who recognised that though he was a hard master, he was also just, and that if he insisted that they should work hard, he never spared himself and could, and did, work as hard as any of them. Moreover, the men, whatever their particular job, were fully aware that he could do what they were doing just as well as they could. Indeed, one of his old foremen is reported to have said of him: "No better shipbuilder ever stood in any yard; he knew theory and practice from A to Z, and in planning big things he had the heart of a lion." There is another point which is not so generally known—because he would not let it be—and that is that, unostentatiously, he was always ready to lend a helping hand, by advice or monetarily, to those who needed it.



ALEXANDER MONTGOMERY CARLISLE

The period covered by his tenure of a leading position in the shipbuilding industry coincided with an extraordinary development in the size of vessels, and in their means of propulsion, and in much of that development he played a leading *rôle*. Two years after his apprenticeship began he witnessed the launch of the first Oceanic for the White Star Line. She was a vessel of but 3000 tons, but she was epoch-making at the time of her launch. Some seventeen years later came the second Oceanic, which was put into the water in January, 1899, and was regarded almost with the same awe as had been in their time the Seven Wonders of the World, for she was the largest steamship that had ever been built, with her tonnage of over 17,000 and her dimensions, which were greater than those of the celebrated Great Eastern. For the design and construction of this huge White Star Liner Mr. Carlisle was very largely responsible. We had the good fortune to attend the launch which, notwithstanding her size and weight—she was by far the largest vessel which had ever been launched stern foremost, the Great Eastern, it will be remembered, having been launched broadside on—was carried out with great success and, we believe we are right in saying, at exactly the predetermined minute.

This leads up to a matter in which Mr. Carlisle was pre-eminent. His capacity for organisation was well-nigh phenomenal. On the occasion of the launch of the second Oceanic, he showed us a schedule of dates which he assured us had been prepared before even the first plate of the keel had been laid. Step by step the construction of the hull was mapped out. So much must be done by such and such a date; so much more by another date, and so on until, finally, the day and hour of launching were specified. Those were fortunately busy days in shipbuilding, and almost before the Oceanic was water-borne, certainly before the end of the day, steps had already been taken to lay the keel plate of the next ship that was to be built on the berth she had occupied.

To enumerate all the vessels which were built at Queen's Island under Mr. Carlisle's *régime* would be impossible in a memoir of this kind, so numerous were they. The White Star fleet, alone, constructed during that period constitutes a formidable list, and each, as it came, brought with it some new development and improvement. Names which spring to mind at once are the Britannic and Germanic, the famous Teutonic and Majestic, and the still more famous Celtic, Adriatic and Olympic, and the ill-fated Titanic. During his time, too, there were immense advances in the power of the propelling machinery, and one of the innovations which were introduced while he was in charge was the combination of wing propellers driven by reciprocating steam engines and a centre propeller driven by a turbine which took its steam from the low-pressure cylinders of the reciprocating engines. Exactly to what extent Mr. Carlisle was responsible for all this progress it is, of course, impossible to say definitely, but it can be safely stated that it was considerable.

Mr. Carlisle's autocracy was by no means confined to members of the staff and the workpeople. Clients for whom vessels were being built, other visitors, and the inspectors who visited the works to witness the work of construction, all had to conform to regulations which he had framed and which were sufficiently stringent. At the luncheon table, which was attended by heads of departments, and to which visitors to the works were sometimes invited, he presided, and had no hesitation in showing his displeasure if the portions of viands and beverages, which he served with his own hand—sometimes all too plentifully—were not entirely consumed.

Other outstanding features of his character which, it may be said, was exceedingly complex, are evidenced by the following. Though we understand that he was repeatedly offered it, he would never accept a partnership in the firm, nor did he at any time hold any shares in it. He used to say that he felt himself more at liberty to work in its best interests when he himself had no financial stake in it. He preferred, so he often averred, to be its paid servant. Moreover, in spite of numerous tempting offers from other shipbuilding undertakings at home and abroad, he resolutely refused to sever his connection with the Belfast firm. Then again, as showing the promptitude with which in cases of emergency he made up his mind and acted, we may say, that on an occasion when a severe fire gutted one of the shops, the orders for new building materials and for machines, to replace those which had been destroyed in the conflagration, had been made out and posted before the ruins had done smoking.

In 1910, after forty years' service with the firm, during the major portion of which he had held supreme command, Mr. Carlisle retired owing to failing health, to the regret, it is said, of everyone connected with the firm from Lord Pirrie himself to the humblest workman. His services as adviser and consultant were, however, retained. In 1907 he was sworn of the Irish Privy Council, which entailed the privilege of a seat at the foot of the Throne in the House of Lords. That circumstance led up to an incident which occurred in the Upper Chamber in 1920, on the occasion of the motion for the second reading of the Restoration of Order in Ireland Bill, which created a great commotion at the time, but which need not be further mentioned here saving to say that it resulted in his being deprived of the privilege of admission to the steps of the Throne. Though a thorough martinet in the shipyard and a stickler for the observance of its rules and regulations, in his private life Mr. Carlisle was a bohemian of the bohemians; impatient of ceremony, and refusing to conform with conventions. In speech he was occasionally brusque almost to rudeness, and in many ways he was decidedly eccentric; but he was essentially a man who had the courage of his opinions.

In addition to his work at Queen's Island Mr. Carlisle was, in 1908, a member of the Departmental Committee on Accidents in Factories and Workshops. He was also called upon to give evidence before the Admiralty Committee on the reconstitution of the Royal Corps of Constructors, and served on the Merchant Shipping Advisory Committee on life-saving appliances.

Literature.

The Smoke Problem of Great Cities. By Sir NAPIER SHAW, LL.D., Sc.D., F.R.S., and JOHN SWITZER OWENS, M.D., A.M. Inst. C.E. London: Constable and Co. 1926. Price 22s. 6d. net.

THIS important work has appeared at an opportune moment, for the Government's Smoke Abatement Bill, based on the report of Lord Newton's Committee, is to be introduced during the present session of Parliament, and the subject with which the book deals is therefore likely to be keenly discussed during the next six months. Sir Napier Shaw, as former head of the Meteorological Office, naturally writes with great weight on this subject; while Dr. John S. Owens, as hon. secretary of the voluntary committee formed in 1912 for investigation of atmospheric pollution, is almost equally well known as an authority on smoke and fog. The book is based upon observations carried out by the voluntary committee, and gives in most readable form a large portion of the matter contained in the eleven annual reports, published by the Committee since its formation in 1912. In the Preface the authors give the early history of the observations, and describe the gradual evolution of the Committee into its present status as an advisory committee attached to the Meteorological Office Department of the Air Ministry.

The book is divided into seventeen chapters, the first three being of a preliminary character, and discussing the historical and geographical aspects of the problem; the natural ventilation of cities; and the nature and origin of smoke. In Chapter IV. the problem of the production of smoke in steel reheating and annealing furnace is dealt with, and a report made by Dr. Owens on this particular subject for the Coal Smoke Abatement Society, is reproduced in full. As showing the attitude of the authors towards the whole problem, the following extract may be quoted:—

"Nothing can be done to solve the problem, however pressing it may be, without some effort not merely on the part of a few enthusiasts, but by the general public. The difficulty is that when we come to persons it is not one's own smoke that fouls one's own atmosphere; there is a natural tendency to wait until other people have shown some activity before bestirring oneself, and that in spite of the fact that in the great majority of cases the smoke is not produced for its own sake, it is merely a by-product of cooking or warming or driving machinery or some other industrial occupation. Nobody wants the smoke, and indeed it is just because they do not want it that they throw it into the atmosphere."

Chapter V., upon the "Economic Aspect," is one of the longest and most valuable in the book, and contains some very good reproductions of photographs showing the effects of London's smoke upon the stonework of Buckingham Palace Mews, the Tower of London and Chelsea Hospital. Curves are also given showing the effects of fog upon the death-rate in London, and these should be studied carefully by all interested in the public health aspect of smoke abatement. Chapters VI. to XIII. deal with the various forms of instrument used during the past ten years in London and other cities for the measurement of air pollution. Many of these instruments are due to the work of the Committee and to the inventive ability of Dr. John S. Owens. Details of the results obtained with them have been published annually in the reports of the Advisory Committee, and are here summarised. Chapters XIV. to XVII. deal with the "Remedy," and are deserving of the attention of all persons interested in the practical aspects of the smoke problem. On the subject of low-temperature coke, the authors, after describing the various processes now being tried upon an industrial scale for its manufacture, say:—

"These are only a few of the processes which have been or are in operation, and doubtless, after sufficient trial there will be a tendency towards unification of method, but this is not likely to occur until the demand for smokeless fuel is sufficiently great to bring about a rapid development of low-temperature carbonisation."

With regard to "Industrial Smoke," which is dealt with in Chapter XVI., they say:—"When the rate of fuel consumption is kept within certain limits, depending on the particular arrangements, and if the furnace is suitably designed, smoke can be almost entirely prevented. If, however, the furnace has to be forced and made to burn more than it is designed for, incomplete combustion results, with the production of smoke. Thus the relation between the grate area and the duty of the furnace is of great importance, from our present point of view. . . ."

"One precaution should always be taken; that is, some provision should be made by which the fireman is able to see the top of the chimney. This cannot always be done directly, but it should always be possible to arrange mirrors so that the fireman can get a view of the top of the chimney. He will then be able to see whether his air supply is being adjusted properly and to keep the smoke emission under proper control."

In the concluding chapter of the book, the authors discuss the legislative aspects of the subject, and describe what they consider to be the most hopeful method of attacking the smoke problem. Their plan is to remit some portion of local taxation to those householders who adopt the best possible means for the abatement of smoke. In the authors' opinion:

"Three things are therefore necessary in order to make an effective start in removing the evil, which is universally acknowledged in words, and almost universally ignored in action. These three things are:—(1) The remedy must be applicable to domestic smoke as well as to industrial smoke; (2) the public in general must be consciously interested in the success of the scheme; (3) the remedy must make some direct appeal to the individual smoke owner." The application of the system they propose, in such a district as the West End of London is then described in detail; and they state that it is rather on these lines, than by the enforcement of fines and penalties, that they expect the solution of the smoke problem to be attained.

The book is well printed and bound, and as a valuable contribution to the literature of the subject, should be put into the hands of every medical officer of health and of every public health official in the country.

BOOKS RECEIVED.

The Radio Press Year-book, 1926. London: The Radio Press, Ltd., Bush House, Strand, W.C. 2. Price 1s. 6d. net.

Die Technische Mechanik. Volume II. *Festigkeitslehre.* By M. Samter. Charlottenburg: Robert Kiepert. Price 6·20 Mk.

Engines of High Output. By H. R. Ricardo. London: Macdonald and Evans, 8, John-street, W.C. 1. Price 7s. 6d. net.

The "Motor Ship" Reference Book, 1926. London: The Temple Press, Ltd., 7–15, Rosebery-avenue, E.C. 1. Price 5s. net.

The Practical Saw Doctor. By R. W. Todd. London: William Rider and Son, Ltd, 8, Paternoster-row, E.C. 4. Price 5s. net.

Modern Drying Machinery. By H. B. Cronshaw. London: Ernest Benn, Ltd., 8, Bouverie-street, E.C. 4. Price 6s. net.

Centrifugal Dryers and Separators. By E. A. Alliott. London: Ernest Benn, Ltd., 8, Bouverie-street, E.C. 4. Price 6s. net.

Über die Natur der Elektrizität. By Leo Gilbert. Vienna: Anzengruber-Verlag Brüder Suschitzky, Favoritenstrasse, X., Vienna.

Metal Spraying. By T. H. Turner and N. F. Budgen. London: Charles Griffin and Co., Ltd., 42, Drury-lane, W.C. 2. Price 15s. net.

The Quantum Theory of the Atom. By G. Birtwistle. London: The Cambridge University Press, Fetter-lane, E.C. 4. Price 15s. net.

Plasterwork Construction. By G. P. and G. E. Blankart. London: The Architectural Press, 9, Queen Anne's Gate, S.W. 1. Price £1 1s. net.

The "Express" Per Gross and Per Dozen Reckoner. By J. Gall Inglis. London: Gall and Inglis, 31, Henrietta-street, W.C. 2. Price 2s. 6d. net.

Beitrag zu den Grundlagen der Schnellaufenden Halbdieselmotoren. By Dr.-Ing. Karl Büchner. Halle (Saale): Wilhelm Knapp. Price 3·50 Mk.

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A List of English Clubs, 1926. By E. C. Austen-Leigh. London: Spottiswoode, Ballantyne and Co., Ltd., New-street-square, E.C. 4. Price 7s. 6d. net.

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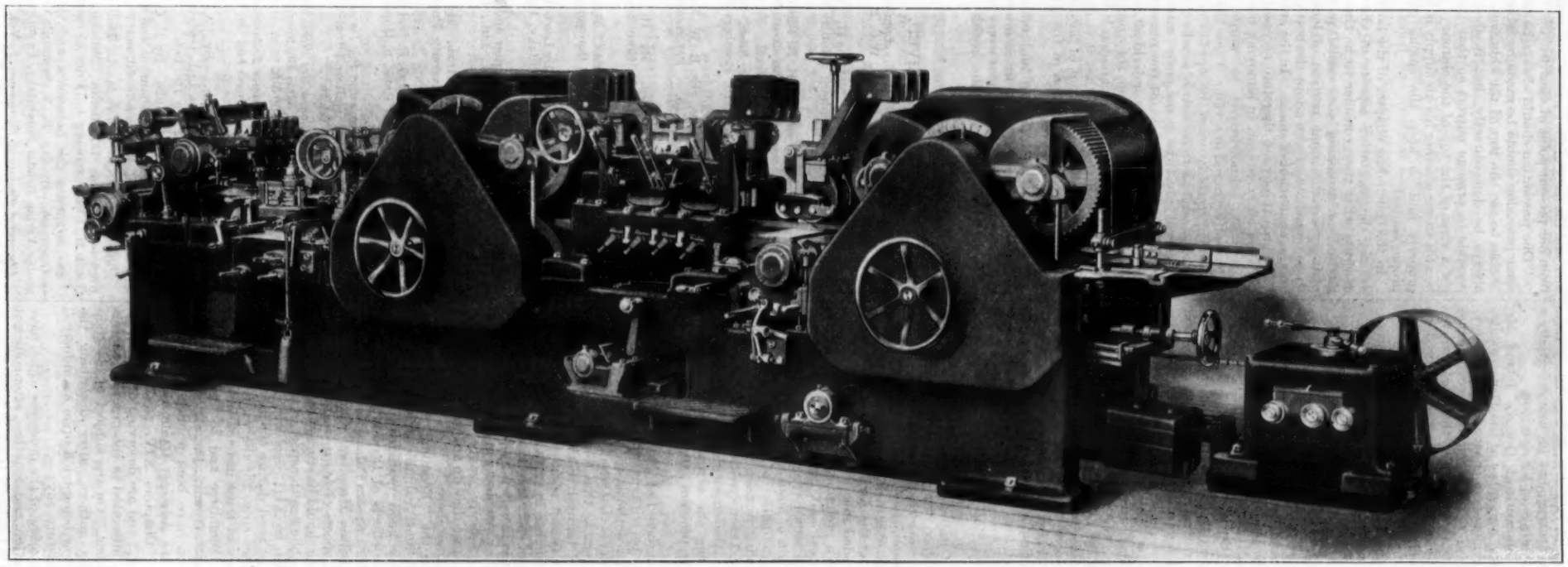
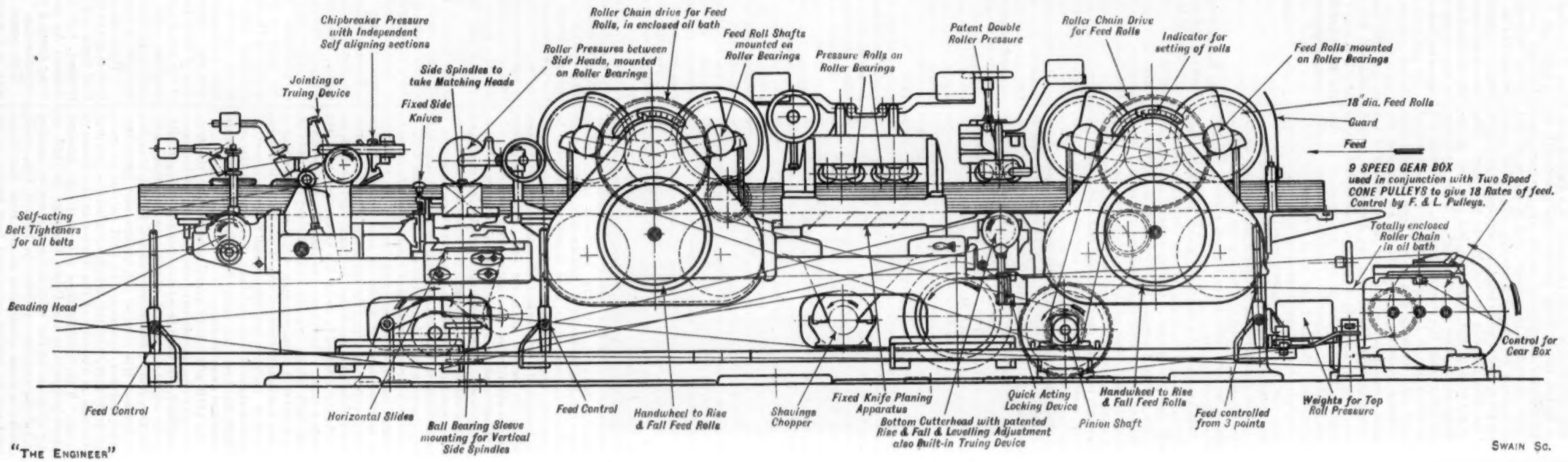
L'Enseignement Technique, Bulletin mensuel du Musée Professionel de l'Etat à Morlanwelz-Mariemont. 15e Année, No. 1. Janvier, 1926. Published by the Directór of the Museum, Morlanwelz, Belgium.

HIGH-SPEED PLANING AND MATCHING MACHINE

THOMAS ROBINSON AND SON, LTD., ROCHDALE, ENGINEERS

(*For description see opposite page*)




Chipbreaker Pressure with Independent Self aligning sections
Roller Chain drive for Feed Rolls, in enclosed oil bath
Feed Roll Shafts mounted on Roller Bearings
Patent Double Roller Pressure
Roller Chain Drive for Feed Rolls
Indicator for setting of rolls
Feed Rolls mounted on Roller Bearings
Jointing or Truing Device
Side Spindles to take Matching Heads
Roller Pressures between Side Heads, mounted on Roller Bearings
Pressure Rolls on Roller Bearings
18" dia. Feed Rolls
Guard
Feed
Fixed Side Knives
9 SPEED GEAR BOX used in conjunction with Two Speed CONE PULLEYS to give 18 Rates of feed. Control by F. & L. Pulleys.
Self-acting Belt Tighteners for all belts
Totally enclosed Roller Chain in oil bath
Beading Head
Control for Gear Box
Feed Control
Horizontal Slides
Ball Bearing Sleeve mounting for Vertical Side Spindles
Feed Control
Handwheel to Rise & Fall Feed Rolls
Shavings Chopper
Fixed Knife Planing Apparatus
Bottom Cutterhead with patented Rise & Fall & Levelling Adjustment also Built-in Truing Device
Quick Acting Locking Device
Handwheel to Rise & Fall Feed Rolls
Pinion Shaft
Feed controlled from 3 points
Weights for Top Roll Pressure

"THE ENGINEER" SWAIN Sc.

High-speed Wood Planing and Matching Machine.

THE wood planing and matching machine which we illustrate in the accompanying engravings has recently been built by Thomas Robinson and Son, Ltd., Rochdale. Its chief features are the chain-driven feed rollers, an improved weighting system for these rollers, a combination of rotary and fixed knives for planing, and the complete equipment throughout with ball and roller bearings, whereby working speeds up to 400ft. per minute are obtainable. These features make the machine particularly suitable for large planing mills, carriage and wagon works, shipbuilding establishments, &c. The frame of the machine,

FIG. 1—ARRANGEMENT OF CHAIN DRIVE

which is well ribbed, has heavy cross ties at frequent intervals, and no portion of the mechanism projects below the floor line.

For speeds such as this machine is designed to work at the feeding mechanism has to be of special design, and in this case the gear consists of eight rollers, 18in. diameter, the shafts of which are mounted in enclosed roller bearings, four rollers being placed at the feeding-in end of the machine and four following the fixed knives, each set having an indicator to show its height above the table. Both sets of feed rolls are driven from a common pinion shaft to the swing or centre shaft of each set by heavy roller chains, which run in an oil bath—a method of driving which reduces the number of wheels required to the minimum and gives silent operation. In order to

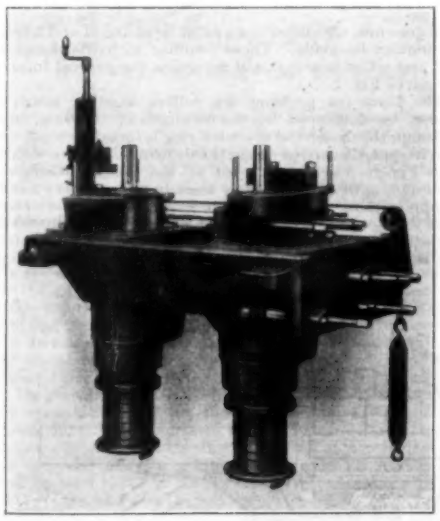


FIG. 2—VERTICAL SPINDLE UNIT

maintain the correct tension on the chains, adjustable sprockets are provided, as shown in the view, Fig. 1. The first two bottom feed rolls and the table in front of the first bottom cutter head rise and fall on inclined slides to vary the depth of the cut, and this adjustment is controlled from the feed end by means of a hand wheel and screw, which are operable while the machine is working. The top feed rolls are carried in "swings" and are driven by machine-cut spur gears from the swing or centre shaft. The bottom feed rolls are carried in roller bearings supported by wedges which have independent screw adjustment for levelling and adjusting the height of the rolls in relation to the table.

The feed is driven by an enclosed chain from the gear-box, shown on the right-hand end of the machine—see page 302. This gear-box gives nine rates of feed, varying from 60ft. to 400ft. per minute. It is controlled by two levers fitted with an automatic index, and the feed is started and stopped by fast and loose pulleys. The feed can also be controlled by means of conveniently placed levers at the feed end, at a point near the vertical side spindles, and at the tailing-out end of the machine. Another novel feature is embodied in the weighting system for the top feed rolls. This is designed so as to prevent excessive movement of the weights while retaining the maximum leverage. The cradle attached to the weight rods is lifted by chain gear and screw, and a weighted lever is suspended below. A second chain anchors the weight lever fulcrum, which rises and falls simultaneously with the cradle, the weight lever remaining approximately level.

The cutter spindles are mounted in large ball bearings enclosed in dust-proof housings, and are carefully balanced at their working speed. The cutters are secured by a wedge arrangement, and can be readily set up by means of a special gauge. Jointing or truing devices are fitted to all the cutter heads. The fixed knife planing apparatus is placed immediately behind the bottom cutter head and carries four independent knife boxes in a massive frame, and the act of withdrawing any one of the knife boxes automatically pulls a planed filling-in piece into the position previously occupied by the knife box. Above each knife box will be seen a series of pressure rollers, which are mounted on roller bearings and a separate hand lever is provided to lift each section. Any one of the knife boxes may therefore be withdrawn and replaced by a box with a sharp knife without stopping the feed, thus enabling two knives to be always in operation. There are also fixed side knives for planing the edges of the timber immediately after passing the side cutter heads. The holders or knife boxes of the side knives rise and fall, and serve as side guides behind the rotary side cutters.

A rotary shavings breaker or chopper is provided below the horizontal fixed knives on a slide carried in the main frame of the machine, and can be quickly drawn out for setting up and adjustment. The spindle is mounted in ball bearings, and a steel hopper is arranged to direct the shavings into the chopper, whence they can be "piped" to a pneumatic collecting system.

The bottom cutter spindle is carried in a heavy framework of hopper form, supported on one side by a round-headed slide shown in the drawing, and on the other side by a flat slide, the latter being capable of being raised and lowered by an excentric, which gives a tilting movement to the frame about the round headed slide, thereby providing a sensitive rise and fall adjustment. An improved method of backing the frame in a downward direction is embodied and the complete mounting is patented. Provision is made for levelling the slides and for drawing the cutter head and frame completely out to give access to the knives. Fast and loose pulleys, mounted independently, are provided for the cutter spindle, so that the belt remains undisturbed when the cutter head is withdrawn. The truing device for this head is of the built-in type, with a specially wide slide, which is covered and protected against gumming up when the emery stick is pushed back to the "off" position.

The vertical side spindles have plain ends, 1¼in. diameter, to take self-centring cutter blocks, and are carried in ball-bearing sleeve mountings, each spindle and its bearings being mounted in a circular housing, and being fitted with means for rise and fall adjustment. The circular housing carrying each spindle—see Fig. 2—has two ball bearings, one at the upper end, with the ordinary shaft mounting secured by lock nut, while the bearing at the lower end is supported by a steel extension or sleeve of the barrel through which the spindle passes. The outer race of this ball bearing is contained in the upper part of the driving pulley, which is secured to its spindle on a taper mounting; this patented mounting provides for the belt pull being taken by the sleeve and not by the spindle. The circular housings or barrels are carried on wide saddles or slides, bored vertically to accommodate the housings, the upper boss being split and fitted with a tightening screw for locking the barrel in position when the vertical adjustment has been made. The rise and fall adjustment is made by means of a wedge or inclined key, housed in the saddle or barrel and moved transversely by means of a worm, rack and spline shaft, the latter being brought to the front of the machine for ease of access.

The top cutter head frame is securely held at each end by locking levers, the bearing housings being connected by cross ties, both below the bed and behind the cutter block. The frame is raised and lowered by two screws actuated by a single crank from the front of the machine, the height being indicated by a graduated scale. An extra bottom-beading cutter spindle, with a removable front bearing arranged to carry various types of cutter heads, is provided behind the top cutter head, and it has vertical and horizontal adjustments. The table behind this head is also vertically adjustable, and can be swung out of the way to give access to the cutters. It is provided with an adjustable pressure to carry wood pads or slippers. The pressures throughout the machine are designed to reduce the time taken in setting up, and are self-adjusting as far as possible, all the rollers having roller bearings.

Roller pressures of large diameter are provided between the side cutter heads to hold the timber down while it is being matched. These pressures have independent flexible adjustment, and are raised and lowered by a hand wheel in the front of the machine. In front of the top cutter head the pressure is of the sectional chip breaker type, with renewable steel shoes.

Illustrations of the tonguing and grooving heads are given in Figs. 3 and 4. One of the chief difficulties in obtaining well-finished matching and flooring boards at

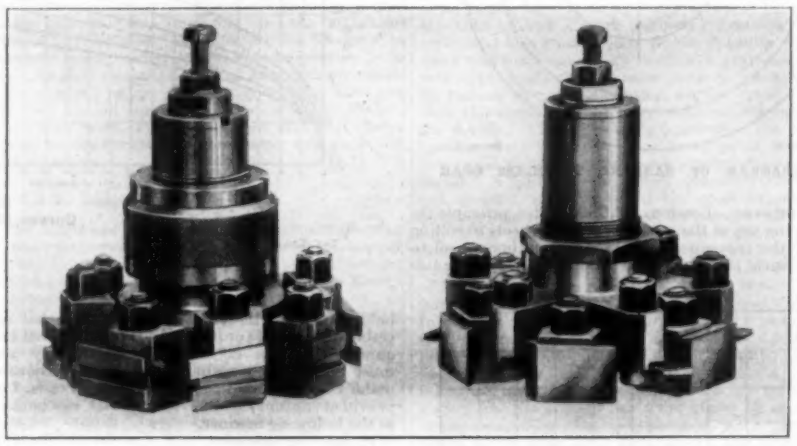


FIG. 3—TONGUING AND GROOVING HEADS

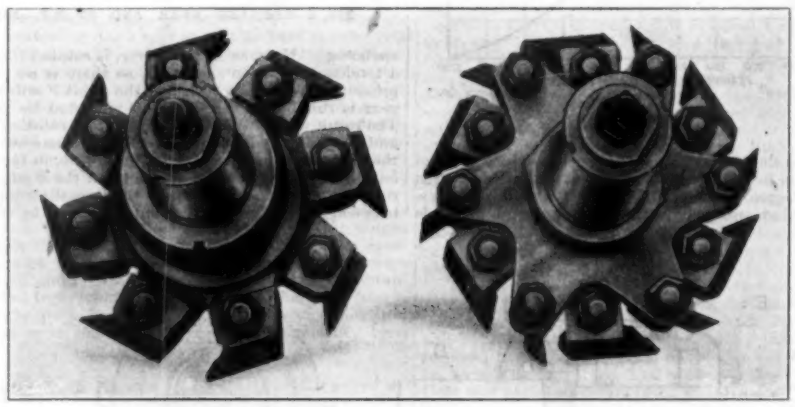


FIG. 4—CUTTING HEADS

high speeds is the side cutter heads for making the tongued and grooved edges. This trouble has been overcome by the use of multiple bit heads with inserted cutters. The heads have been designed specially to enable the cutters to be easily jointed or "trued up," either while in position on their spindles or separately. To enable this process to be carried out on the grooving head, the cutters can be released *en bloc* from the head by simply releasing one nut, and by this arrangement the edging cutters are left undisturbed. The tonguing head carries eight bits, which are clamped in dovetail grooves, and every alternate cutter is set at an opposite angle to the tongue to give sufficient side clearance to prevent burring. The grooving head has six straight-edging and six grooving cutters, the former being clamped in dovetail grooves, the grooving bits being held by slotted bolts, so that they can be quickly changed. These patented heads are designed for outputs up to 400ft. per minute.

When our representative witnessed the machine in operation at the makers' works the maximum planing speed attained was 367ft. per minute, but, we understand, that a speed of 400ft. per minute has since been reached.

A Toothless Gear.

A NEW application of an old and established principle in the transmission of power has recently been developed and brought to a practical stage by Garrard Gears, Ltd., of 109, Kingsway, London, W.C. 2. The principle in question is the use of the adhesion of two wheels in rolling contact for the transmission of power from one wheel to the other, with the object of producing a speed ratio between two shafts. Many gears of such a nature have, of course, been produced, and some have worked with a moderate degree of success, but the gear under review embodies what, we believe, is quite a novel principle and escapes many of the disadvantages of older forms.

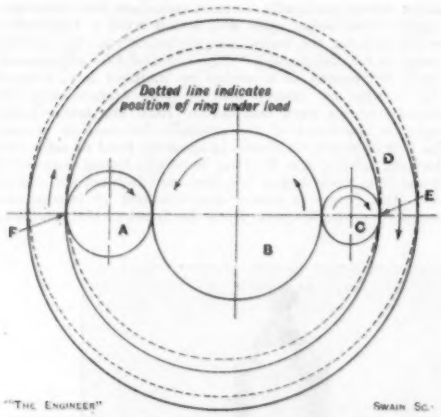


FIG. 1—DIAGRAM OF GARRARD TOOTHLESS GEAR

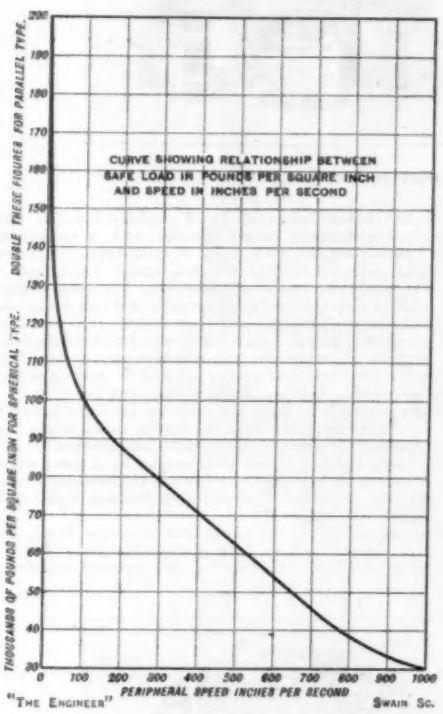
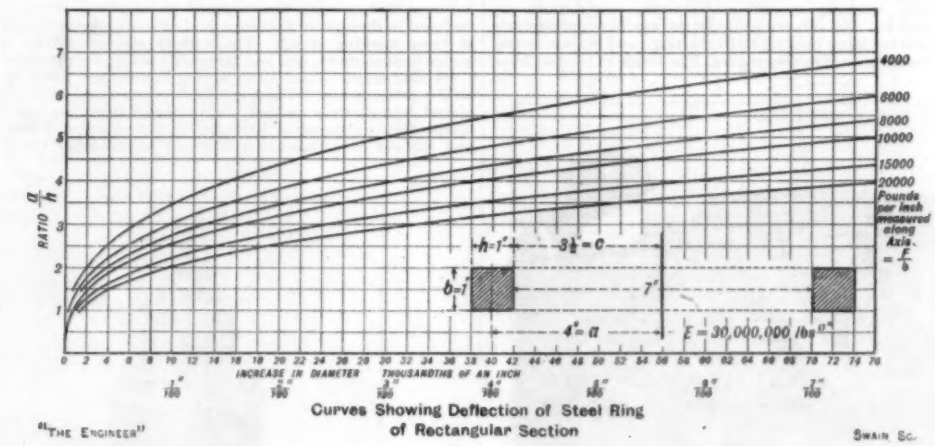

CURVE SHOWING RELATIONSHIP BETWEEN SAFE LOAD IN POUNDS PER SQUARE INCH AND SPEED IN INCHES PER SECOND
DOUBLE THESE FIGURES FOR PARALLEL TYPE.
THOUSANDS OF POUNDS PER SQUARE INCH FOR SPHERICAL TYPE.
PERIPHERAL SPEED INCHES PER SECOND
"THE ENGINEER"
SWAIN SC.

FIG. 2

Friction gearing is admittedly desirable on account of its silence and cheapness, as compared with toothed gears, but generally suffers from the disadvantage that the pressure necessary to prevent slipping has to be transmitted through the bearings and framing, with a corresponding loss of efficiency. Mr. Garrard has, however, got over this handicap in an ingenious yet simple manner.

The principle of the gear can best be explained with the assistance of Fig. 1, which is a diagrammatic outline of the essential parts. In it A is the driving wheel and B that to be driven. C is an idler and D a ring embracing the whole assembly. The wheels, or rollers, are of hardened steel, ground with a very high degree of accuracy, and the ring, which is also hardened, is stretched very slightly to get it in place. The result is that all the rollers are held firmly together, but not so tightly that any appreciable amount of torque could be transmitted from one to another in this condition. Considerably more force must be used in pressing the rollers together in order to make the gear practicable, and this force is, fortunately, provided automatically, within the mechanism shown, in the following manner.

It may be assumed that the driven shaft B is held stationary. Then the idler C will also be fixed and the point E, where C and D make contact, will form an anchorage. Now, as A, the driver, is rotated there will be a tendency for it to slip on B, as there is no very great pressure between the two, and the point F will rise if the gear is running in the direction indicated by the arrow. The result will be that the ring will rise, rotating about E, and the rollers will be gripped across a narrower part of the ring than the diameter. The grip is, in fact, limited only by the coefficient of friction and the strength of the ring. It will be noticed that not only is the gripping force between the rollers wholly counterbalanced by the tension in the ring, so that no extra load is put on the bearings, but also that two driving contacts are made, one directly between A and B and the other from A to D through C and back to B. The result is, of course, that the rollers can be of half the length that would be necessary if A and B were pressed together by some external force. It is hardly necessary to point out that either of the three rollers can be used as the driver or driven member.



Curves Showing Deflection of Steel Ring of Rectangular Section

FIG. 5

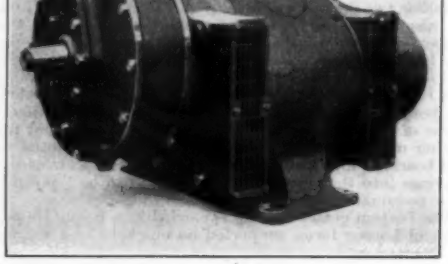


FIG. 6—GARRARD GEAR AND 20 H.P. MOTOR

Engineers will readily agree that such a system of gearing is workable, but may have some doubts as to its wearing qualities. Several sets, which we have inspected minutely after long service, show, however, that no appreciable wear takes place, largely on account of the comparatively light loading adopted in these gears, and in this connection we give two graphs used by the makers in proportioning the gear.

In designing a new set of gears it is necessary to proceed on the trial-and-error principle. Given the speed of revolution, a diameter is taken at random, and the tangential force necessary to transmit the power is calculated. It is always assumed that the radial force to prevent slipping is ten times the tangential load, and on that assumption the pressure between the rollers is readily obtained. From this information the area of contact between the rollers, where they are deformed by the pressure, can be calculated on the same lines as is done with ball bearings, and the pressure per square inch of surface be deduced. Then, by reference to the curve reproduced in Fig. 2, it will be found whether or not the pressure comes within the limits of intensity which practice has shown to be permissible.

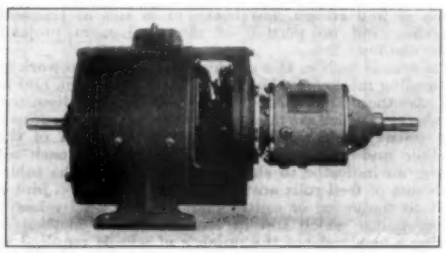


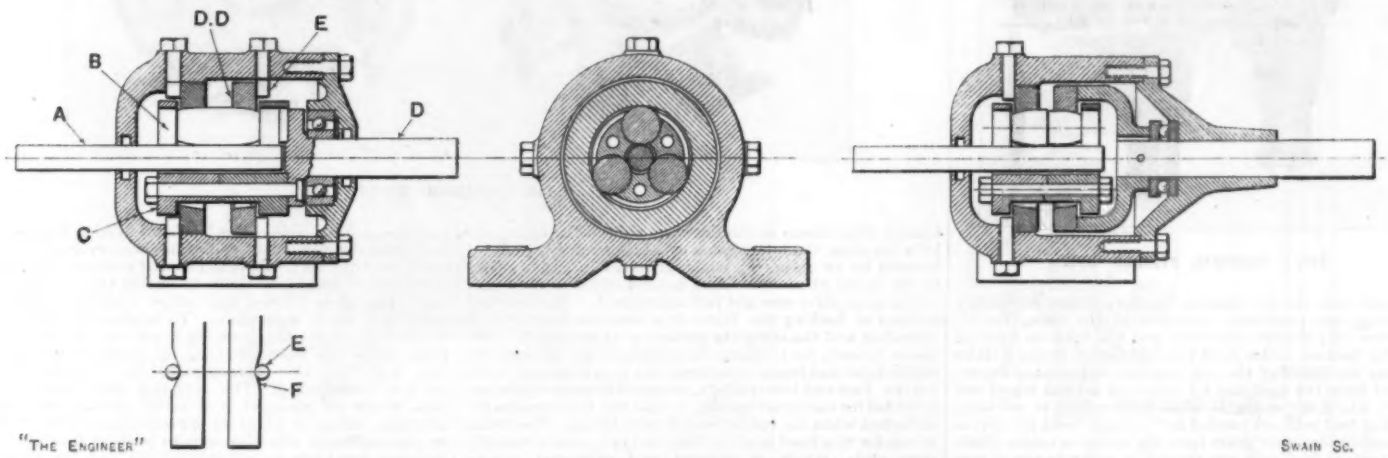
FIG. 7—GARRARD GEAR AND ONE H.P. MOTOR

If it does not, the dimensions must be changed and a fresh calculation be made. Those familiar with the design of ball and roller bearings will recognise the general form of the curve Fig. 2.

The force for pressing the rollers together must, of course, be developed by the strength of the ring, and although the distortion of such a ring is found by a calculation frequently carried out in the drawing-office, we include—in Fig. 5—the curves used by the Garrard Company in designing the rings, as they seem to us to be very handy in application. The curves are based on the assumption that the steel has a modulus of elasticity of 30,000,000 lb. per square inch, and provide a ready means of proportioning the depth and inside diameter to meet a wide range of deflection, according to the formula:—

$$\text{expansion of ring} = 6 \times 10^{-8} \, F \, \frac{a^2}{b \, h^3}.$$

The internal radius of the ring is c; the radial depth h, and the length along the axis b; the expanding force F.



FIGS. 3 AND 4—APPLICATIONS OF THE GARRARD TOOTHLESS GEAR

The mean radius of the ring will be the quantity $c + \frac{1}{2}h$; this is called a in the formula. Each of the curves shown is plotted for a given force in pounds per inch, measured along the axis. That is, all the points on each of these curves represents a fixed value of the quantity $\frac{F}{b}$. The figures on the left of the chart represent the value $\frac{a}{h}$; that is, they are the ratio of the mean radius divided by the radial depth.

The external diameter of the whole ring will be $2a + h$, and the internal radius $2a - h$. In the case of the ring shown in the sketch with dimensions attached, the value of a is 4in., $h = 1$in., and $b = 1$in. The ratio of $\frac{a}{h}$ is, therefore, 4. The internal diameter of the ring is 7in., and the external diameter is 9in. If the ring is subjected to an outward force of 10,000 lb. the expansion can be found from the curve marked 10,000, and will be about thirty-eight thousandths of an inch (0·038in.). If the force increases to 15,000 lb. the expansion will become 0·058in., and if it decreases to 4000, the expansion will be 0·0153in. It is assumed that the force would never fall below 4000, on the smallest curve given, or rise above 20,000 at the largest, and the intermediate values can be interpolated from the curves.

On account of the fact that the rollers are deformed by the radial pressure the shafts must, of course, move towards each other when under load, but the movement is so slight that an ordinary bearing will accommodate it in most sizes. For big gears, however, the bearings are allowed to slide. When very long rollers have to be adopted to transmit large powers, it is usual to employ several separate rings, instead of one wide one.

The constructional details of the gear need little description, as they follow orthodox engineering practice where accurate grinding and hardening are required. Figs. 6 and 7 illustrate two typical gears fitted on electric motors, and show how compactly they can be made. In the case of the set shown in Fig. 6, the casing, which, by the way, is oil-tight, can be turned round to several different positions, so that the offset of the driven shaft can be changed to suit the drive.

The gear shown in Fig. 7 is not really quite the same in principle as Fig. 6, but it embodies a frictional drive and, to some extent, similar ideas to those just described. Its construction can best be followed with the aid of Fig. 3.

The driving shaft A is surrounded by hardened steel rollers B, which are carried in a phosphor bronze cage C,

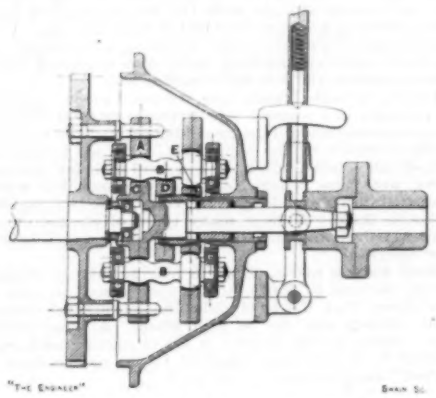


FIG. 8—GARRARD GEAR FOR MOTOR BOAT

which is bolted to the driven shaft D. The driving shaft is in contact with and drives the rollers at the parallel portion at each end of the roller. The rollers are enclosed by hardened steel rings D D, which are accurately ground to a curved surface of a slightly larger radius than the curve of the rollers. These enclosing rings have four radial V-shaped inclines ground on their side faces as shown at F—which inclines are in sliding contact with the pins E. The moment the driving shaft starts to rotate the rollers, the encircling rings also tend to rotate, thus sliding the V-shaped inclines in the rings up against the fixed pins. This closes the rings together, thereby putting pressure on to the rollers, and transfers the driving power to the cage which revolves the driven shaft. These particular gears are intended only for comparatively small powers and do not work with pure rolling friction, as there must be some slip on account of the curvature of the surfaces in contact. Such gears as we have inspected show, however, that this slipping is not detrimental to the surfaces of the metal. A further development of the idea is illustrated by Fig. 4, which shows an epicyclic gear for giving a high ratio of speeds. It will be seen that the driven shaft is connected with one of the rings, and that the rolls have two different diameters, so that the ratio is dependent on this difference.

An application of the gear which has been used on a motor boat for reversing purposes is illustrated in Fig. 8. In this case, it will be seen, curved rollers are again used. The drive from the engine is transmitted to the ring A by the pegs shown, and consequently rolls the rollers B B round on the inside race C, which is fixed on the end of the propeller shaft. Either of the races D and E can be clutched on to the fixed double cone by moving the whole assembly endways. When E is engaged there is a forward drive with a 4 to 1 reduction in speed, and with D held by the cone clutch the propeller is reversed at a slightly slower speed.

Although we are not able to give independent detailed figures as to the mechanical efficiency of these gears, there is every reason to assume that it is high, and the makers assure us that with the plain cylindrical rollers an efficiency of 98 per cent. is obtained at all loads, while some tests which we witnessed showed that the heat generated inside a 25 horse-power gear at full load, which, of course, represented the internal losses, could be supplied electrically at an expenditure of 200 watts. They will carry heavy overloads, and we failed to make a set slip even with the assistance of a long pinch bar. Incidentally the rollers were not marked in the least by this severe treatment. A turbine gear for transmitting 1000 horse-power at 6000 revolutions per minute is now being made in the Midlands, and it is hoped to subject it to exhaustive tests very shortly.

South African Engineering Notes.

Labour-saving Elevators.

It is stated that the Union Railway Board intends in the near future to recommend a big scheme for the construction of grain elevators. At present the railway authorities are proceeding with the construction of a new type of grain elevator at Settlers on the Springbok Flats. It is to be erected departmentally, will have a capacity of 17,500 bags, and was designed by an official of the Railway Department in Johannesburg. There will be no conveyor belts with the exception of a small one from the rail intake to the boot of the elevator. The grain is to be taken in by mechanical power and released by gravitation into the trucks. As it is simple in design, only two men will, it is said, be required to operate it, as compared with the four or five men needed for the elevators now in service. Should the experiment prove successful, all other elevators that may be constructed in the Union will probably be of the same design.

Large S.A.R. Orders.

The Railways and Harbours Administration of the Union has contracted for the supply of 70 50-ton hopper wagons by the Leeds Forge Company, Ltd., at £575 each, and 170 40-ton steel drop-sided bogie wagons by the Metropolitan Carriage Wagon and Finance Company, Ltd., at £478 each. In addition, it is announced that 500 all-steel bogie grain trucks have been ordered from the Leeds Forge Company and 500 from the Metropolitan Carriage Company. Tenders have been called for the supply of 53 locomotives, consisting of 23 of the heavy "Mountain" type, 10 of the heavy Garratt model, and 20 lighter Garratt locomotives for branch lines. The locomotives will cost about half a million, and the whole of the trucks will probably entail the expenditure of a like sum.

World's Largest Water Valve.

What is said to be the largest regulating valve ever made by any engineering firm in the world recently arrived at Durban from England. It was made by J. Blakeborough and Sons, Ltd., of London, and has been brought out for the new Shongweni Waterworks. The original idea was to put in fifteen small valves, but Mr. Walter M. Campbell, Durban borough water engineer, decided to save money and gain efficiency by installing one very large one. The valve will deliver 1100 cubic feet of water a second, which is nearly 25,000,000 gallons an hour and over 590,000,000 gallons a day. The second of the two large tunnels in connection with the Shongweni Waterworks was completed during last November, and tends to confirm the engineer's confidence that the work will be completed within schedule time, by September of this year. This tunnel, the dimensions of which are 7ft. by 5ft. by 1¼ miles in length, is the second largest of its kind in South Africa, the first tunnel, completed some months ago and situated below the dam, being the longest.

Union's 1925 Maize Crop.

The Union Office of Census and Statistics has issued a statement with regard to the 1925 maize crop, which states that the preliminary results of the agricultural census give the total production of maize for the Union, during 1925, as 24,162,000 bags, as compared with 11,238,842 bags for 1924, and with 19,763,791 bags for 1923. The 1923 crop was the largest previously recorded, so that 1925 establishes a new record. As the average annual consumption over the last five years in the Union has been 10,624,000 bags, the exportable surplus for 1925 is 13,538,000 bags. The quantity exported from July, 1925, to January, 1926, was 10,247,727 bags, which is equivalent in weight to 1,024,000 tons, whereas the weight exported in 1924 was only about 80,000 tons. The enormous increase of the crop in 1925 caught the railways unprepared, and compelled the Administration to obtain locomotives from wherever it could get prompt delivery. It is for the purpose of avoiding further congestion and delay that more engines and trucks have recently been ordered.

A Large Rock Hoist.

The largest rock hoist in the world is under construction at No. 3 shaft of the Government Gold Mining Areas—State Mines. It is capable of drawing 8 tons of rock from a depth of 4000ft. It is estimated that when the hoist is completed the present monthly haulage total of 175,000 tons of rock will be increased by 50,000 tons.

Motor Car Centre.

Port Elizabeth is apparently destined to become the chief centre in South Africa for the manufacture and distribution of motor cars. Something of this was indicated when the Ford Motor Car Company selected it as its assembling and distributing headquarters in South Africa. It is now announced that the Colonial Motors Corporation, which handles, among others, the Chevrolet and Buick make of cars, is planning an assembly plant and distribution centre to be established there. It is understood that this undertaking will involve the erection of an extensive factory and storage accommodation with plant equipment. The Ford Company, which is at present housed in leased buildings, recently purchased an extensive factory site from the Municipality, and building operations upon it will, it is stated, be begun in the very near future, and it is understood that the Ford Company will undertake a fair measure of the actual manufacturing processes in the new factory.

Rhodesian Irrigation Project.

Details of how the Umtali Irrigation Project for watering nearly 3000 acres of farm lands in the valley of the Ngambi River was constructed in Rhodesia have recently been furnished by Mr. T. W. P. Smith. Mr. Smith states that the problem of crossing the divide between the catchment areas of the Odzani and Umtali rivers in Rhodesia, for the purpose of irrigating nearly three thousand acres of rich farming land, has been successfully solved, and the result is one of the most promising irrigation projects in the country. The land that will be benefited lies in the valley of the Ngambi River, which is a tributary of the Umtali. The soil is, for the most part, very fertile red loam. Though portions of it are rather heavy, it is expected to respond well to irrigation. The remainder is more sandy, but well drained and easy to work, and should give excellent results under good treatment. The project, which is known as the Old Umtali Irrigation scheme, because the idea was projected a few years ago, but never fully executed, comprises the cutting of an 8-mile canal to carry water across the divide between the Odzani and Umtali gathering grounds, in order to command the greater part of the Ngambi Valley. This work was made necessary because a previous canal which was to have effected the same purpose was dropped below its highest practical elevation 4 miles from its intake, so that the canal did not have sufficient elevation to cross the divide. The engineering features of the scheme are a gauging weir with necessary head gates, erected in the new canal where it starts above the first drop in the Odzani Canal. A half mile of heavy granite rock cutting was encountered, and it proved the most expensive section of the whole scheme. About 7 miles from the head gates the canal passes around a steep hillside strewn with boulders. It was at one time thought that it would be necessary to flume the worst part of this section because of the unfavourable conditions, but on removing the overburden of boulders the underlying material was discovered to be weathered granite, which was fairly compact, and in it there was little difficulty in cutting out a bench on the hillside in order to take the canal. Eight miles from the head gates the divide is reached. There a branch canal takes off, and the main canal continues up the Ngambi Valley until it crosses the river about 10 miles from the headgates. The river is crossed by an Armco ingot iron flume 140ft. long and 24ft. above the river bed. The flume, which is semi-circular in form, is of galvanised iron, and is carried by timber beams resting on concrete piers. There is a 16ft. span between supports. The concrete piers extend 8ft. above the river bed in order to keep the timber clear of all but exceptionally high floods. The flume is fitted with water-tight joints and rods for hanging the carrier beams. Half a mile beyond the Ngambi River a tributary is crossed by another flume similar to the first. This second one is 78ft. long and 12ft. high. Three additional flumes of smaller size carry the canal down to the Ngambi Valley. The length of the main canal is 15½ miles. Distribution gates are provided at various points along the canal. The work has been carried out within the estimated cost, which was approximately £3000. Citrus fruit, cotton and green feed for dairy cattle and fat stock are the products considered suitable for cultivation on the area embraced by the project, which is situated in one of the healthiest and most charming parts of Rhodesia. In addition, it is only 12 miles from the town of Umtali, so that it possesses favourable conditions for closer settlement.

Large Power Station at Durban.

An early start is to be made on the new super power station which is to supply both the Durban (Natal) Municipality and the South African Railway Administration with electric current. The International Combustion Company, Ltd., has received from the South African Electricity Supply Commission a contract of the approximate value of £250,000 for the erection of part of the equipment of the new station, and tenders for the remainder of the work will be invited shortly. The new station will, it is estimated, cost a total of £500,000, and will be built on a site not far from the new graving dock. Mr. John Roberts, the Durban Borough Electrical Engineer, who is also the local manager for the Electricity Supply Commission, states that the contract just given out is for boiler equipment including erection. Tenders were invited for two methods of coal burning, namely, by mechanical stokers or by pulverised fuel. The tender accepted employs the second method, and the Lopulco plant to be installed will be the first large modern pulverised fuel plant in South Africa. The machinery contract, Mr. Roberts states, will very shortly be placed. Tenders for the foundations will be invited as soon as the necessary plans have been received from the consulting engineers, but they cannot be completed until the final contracts have been made. Only half of the station is being proceeded with at present, but it will be large enough to deal with a load of 30,000 kilowatts, while the ultimate capacity of the complete station will be double that figure. The maximum load of the present station is about 14,000 kilowatts. It belongs to the Municipality. The new station will be about the same size as that at Colenso, which supplies power to the electrified portion of the Natal Main Line, and the large stations of the Victoria Falls Power Company. The new plant is to be completed by October, 1927, and will be under the management of the Electricity Supply Commission. Durban's position has been safeguarded by an agreement. The Commission will supply the railway and also current for the main line electrification when it is extended from Pietermaritzburg to Durban, but it will not be permitted to supply direct to the consumers in Durban or within 16 miles of the Durban boundary, the Durban Corporation having been given the sole right to supply consumers in that area. The present contract placed is for all British equipment.

A SCHEME for the commercial utilisation of the grass tree has been started in the Ararat District of Victoria. It is proposed to extract tanning materials, gum and oils.

Metal Aeroplane Developments.

IN our issue of November 3rd, 1922, we gave a fairly lengthy general description of the system of metal aeroplane construction developed after considerable and expensive research by Boulton and Paul, Ltd. of Norwich. Since that date the firm has made progress with this class of work in several interesting directions, the chief of which we now propose to indicate.

In our previous article it was remarked that the constructional material principally employed at the Norwich Works was nickel-chrome steel received from the makers in a hardened and tempered condition. This steel had a tensile strength of about 85 tons per square inch, and was supplied to the works in any length desired and up to 6in. or 7in. in width. To bring the material to the required form two processes, separately or combined, were, it was stated, employed, namely, passing it between rolls and drawing it through dies. It was explained that the springy nature of the steel introduced certain difficulties

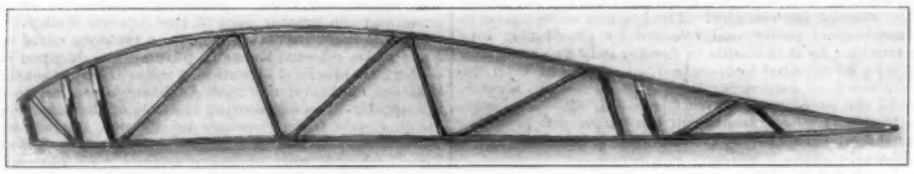


FIG. 1—7ft. DURALUMIN WING RIB, WEIGHT 13 OUNCES

in designing the rolls and dies required to give any desired form, and that heat treatment of the sections, after they had been rolled or drawn, could not be adopted because of the distortion which it would produce. It was found that this system of working was open to an additional disadvantage in that the heat treatment of the steel in coils before being rolled or drawn failed to give uniform results, tests showing a considerable variation in the strength and ductility between different parts of the same strip. As an outcome of the efforts made to surmount these difficulties, the metal is now rolled or drawn in the soft state and is heat treated in a special form of furnace continuously after it has passed through the rolls or dies. This process has eliminated the distortion troubles formerly encountered, and ensures uniformity of treatment throughout the whole length of any member. The metal is also heated in a special furnace before it is rolled or drawn to the desired section, so that the probability of hot working indicated as a likely development in our previous article has been realised.

A change has also been made regarding the material

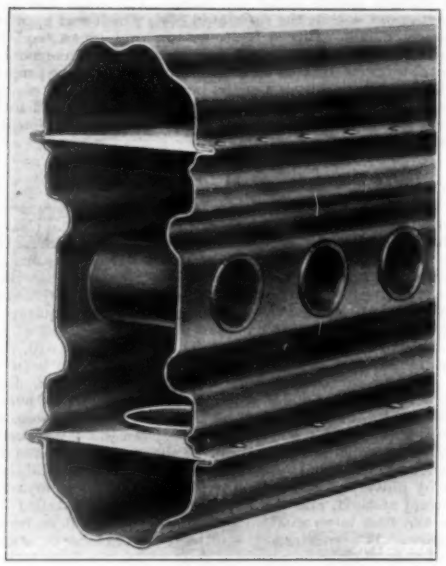


FIG. 2—STEEL MAIN SPAR

itself. Formerly nickel-chrome or ordinary carbon steel was practically exclusively employed for all constructional parts. To-day the principle has been adopted of using high grade steel for the primary parts of the structure, and a light alloy, such as duralumin, for the secondary parts. For example, the wings of a biplane consist of a primary structure comprising the spars, interplane struts and bracings, and a secondary structure comprising the ribs, leading and trailing edges and the wing covering. The comparatively heavy loads which the primary structure is called upon to bear enable the high specific strength of steel to be employed advantageously as a means of economising weight. The secondary structure is subjected to comparatively light loads, and robustness against accidental damage rather than structural strength becomes generally the determining factor in design. In the secondary structure considerations of weight economy would lead to the use of steel too thin to be practicable, and hence light alloys are now employed instead.

Corrosion is, as we pointed out in our previous article, an item requiring careful consideration in the design of metal aircraft, for quite a small amount of it would result in a serious diminution of the effective cross-section of parts composed of very thin sheet metal, while protective coatings may add a quite noteworthy amount to the structural weight. Attention continues to be devoted to the employment of stainless steel, while for steel of the non-stainless variety the firm's investigations have led to the development of coatings which have been thoroughly tested over prolonged periods, including alternate immersions in sea water for six months, and the resistance of the coatings to heat, bending, hot oil, petrol, acid and alkaline solutions and "dope." For the protective treatment of aluminium alloys a process of anodic oxidation has been evolved.

By way of illustrating the firm's recent practice, we give in Fig. 1 an illustration of a wing rib, and in Fig. 2 one of a main spar. The rib is made of duralumin. The booms are formed of special sections, while the profile is maintained by tubular diagonal bracing riveted to the booms. This rib has a chord of 7ft. and weighs 13 oz. The spar, a section of which is included in Fig. 3, is made of high tensile steel strip. The corrugated webs are stiffened and held apart by tubular distance pieces fixed in position by spinning over their ends. The top and bottom edges of the webs are folded over to receive stiffeners of strip metal holed and flanged to give lightness and rigidity. The folds in the webs also receive the edges of the top and bottom flanges of the spar, each of which is rolled to a corrugated section from a strip of metal. Flange, stiffener and web are united by means of riveting through the fold in the web.

Of all the steps in advance made by the firm, the chief is undoubtedly to be found in those taken to secure standardisation of the sections employed for the different structural members. It will be appreciated that to effect some perhaps quite minor change in the form of, say, a wing spar is a much more expensive and troublesome operation if the spar is made of metal than it would be if it is of wood. Whereas some simple adjustment within the ordinary capacity of the spindling machine, or at the most a change of cutters, would secure the required alteration in the case of a wooden spar, new rolls or dies, and possibly a complete resetting of the rolling or drawing machine, would be required in the case of a metal spar. Again, the expense of installing the rolling and drawing plant and the different adjuncts is too great to enable it to be faced by every firm desirous of adopting metal construction. To meet its own needs in this respect, as well as those of other firms whom it may license to use its system of metal parts, the firm has developed a series of standard sections so designed that they may be readily combined in a large number of different ways. For instance, in the case of wing spars, three standard web forms and six standard flange forms have been laid down. Each form may, in addition, be

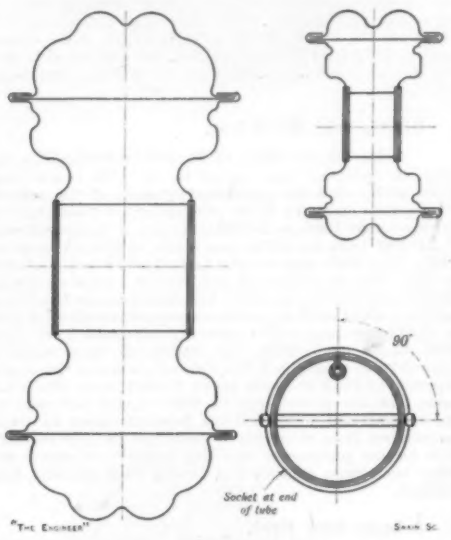


FIG. 3—SPAR AND STRUT SECTIONS

made from metal of different thicknesses. All told, the arrangement permits of the assembly of over two thousand different designs of spar. The range gives a fine gradation of strength and should cover all likely requirements during the near future of machines varying from 2000 lb. to 20,000 lb. in total weight. If the depth of the wing section is fixed choice may be made from eighteen different spars, the strength characteristics of which are accurately known and tabulated. The sections for longerons, struts and other members are similarly standardised on a graded basis. Normally any of the standard sections can be made in lengths up to 70ft., but for special requirements the length can be increased to 150ft.

Two typical wing spars assembled from the standard sections are illustrated in Fig. 3. This engraving also illustrates the form of locked joint tube evolved for such parts as the fuselage struts. The form illustrated in our earlier article was of the "close joint" type, with the abutting edges bent backwards each on itself without gripping the other. To such tubes bands were fitted at intervals along their lengths to hold the edges together. In the new locked joint tube no such bands are required, while, in addition, the locking of the edges together adds considerably to the strength of the tube. This form of tube can be made in great lengths in nickel-chrome or stainless steel, or in light alloy and in all gauges from No. 30 upwards.

In standardising the different sections, attention has been paid to the requirements in the matter of joining the various structural parts together or attaching fittings to them. The dimensions associated with the joining or riveting involved in this connection have been made common to all the standardised sections, so that the riveting tools or machines required for the work will cover the whole range.

JUNIOR INSTITUTION OF ENGINEERS.

AT a meeting of the Institution, held in London on March 5th, a paper entitled "Tendencies in Modern Electric Practice," was given by Mr. J. M. Seddon, A.M. Inst. E.E.

Taking first methods of generating electricity, the author went on to describe several of the latest hydro-electric stations in Sweden. He explained that, generally, turbines with vertical shafts were used for small heads and horizontal shafts for large heads. He emphasised the fact that the civil engineering work in connection with these power stations was very costly, and that the energy supplied by them to consumers was on the average more expensive than that supplied by the cheaper English companies. Their existence was principally justified by the fact that coal was dear.

Steam stations, with special reference to powdered fuel, were next discussed, and stress was laid on the fact that the dust and grit which was ejected from chimneys in powdered fuel plants presented a difficulty, though special fan arrangements had been devised to overcome the trouble. Automatic sub-stations were also mentioned, and in connection with consumers' apparatus, Mr. Seddon stressed the advantages of the squirrel-cage motor, which should, he urged, be used whenever possible.

At a special meeting of the Institution held at the Engineers' Club, Waterloo-street, Birmingham, on the same day, a paper entitled "Lifting and Shifting Machinery—Ancient and Modern Practice," was read by Mr. C. H. Woodfield, M.I. Mech. E.

The engineering feats of the ancient Egyptians in the transportation and erecton of huge monoliths and blocks of stone were first referred to, and the conjectural methods adopted were shown by means of lantern slides, but it was explained that actual information on the subject was small, and that many of their mighty works seemed impossible of accomplishment with the few mechanical aids which so far as we knew they had at their disposal. Unlimited and cheap labour and a thorough knowledge of the lever, roller and inclined plane, with unlimited time, were apparently the only facilities they had.

Passing on to the Middle Ages, the use of a crane, worked by prisoners in a squirrel-cage arrangement, was referred to and mention made of the great advance made by Bramah in his invention of the cupleather. This led to the use of hydraulic cranes, which, by reason of their few moving parts, were very reliable, although uneconomical when compared with the modern electric crane, which was rapidly replacing them. A great many types of electric crane were described, and the advantage of compensated luffing gear described.

Steel wireless masts, 820ft. in height, recently erected by the lecturer in South Africa, were described, and it was shown that the chief difficulty encountered during their erection was due to high winds. A three-storied cage, passing up the interior of the triangular mast, was hoisted by a wire rope attached to the engine from a "Ford" car placed at ground level.

WATERLOO TUBE STATION RECONSTRUCTION

THE following information regarding the reconstruction of Waterloo Tube Station has been issued by the London Underground Railways:—

One effect of the linking up of the Hampstead and City Lines between Charing Cross and Kennington will be the development of Waterloo Tube Station as an important exchange station between the Hampstead and Bakerloo lines. In view of the heavy traffic which will have to be handled at this station in the future, very considerable improvements are to be made to provide for the free and rapid movement of the traffic. Contracts have been placed and work is now in full swing.

As in the case of all modern Tube reconstruction schemes, escalators will be an essential feature. There will be three at the new Waterloo Station running from the top landing, which is 6ft. below the Southern Railway passenger subway, to a lower landing 56½ft. deeper, the latter being on the same level as the corresponding landing for the lifts. These escalators, the centre one of which will be reversible, will be of the comb type and will supplement the existing battery of four lifts. To provide space for the lower landing of the escalators it has been necessary to remove the old spiral emergency stairway and build a new one in another position.

The works at the lower landing of the escalators include the construction of new footbridges, passages and staircases leading to the new Waterloo Station of the Hampstead Railway, and connections to the existing passages leading to the Waterloo Station of the Bakerloo Railway, and an additional passage for the latter.

At the upper level of the escalators there will be a booking hall 52ft. wide, which will be provided with passimeters. Entrance thereto will be obtained from the existing Southern Railway passenger subway by two short flights of stairs.

The new booking hall is also connected to the lower level of the existing escalators leading to the Southern Railway concourse, by a short passage and stairway.

A SIX-FOOT seam of steam coal has been struck at the Cwmgwynfa Colliery, Port Talbot.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

General Conditions.

THE general tone of the iron and steel and heavy engineering industries of the Midlands and Staffordshire is slightly easier, but the actual business done shows little advance. Steel makers continue to work considerably below capacity, with orders of a spasmodic character, and ironmasters are very similarly placed. Constructional engineers are finding a few good orders coming in for spring developments, but more business would be very welcome. The orders recently announced for railway wagons will eventually provide additional employment for local iron and steel works, wagon builders in the Midland area having received substantial assignments.

Steel.

There is very little change in the steel position on the week. Certainly price cutting is a little more rife, and continental competition is keener, but the general level of prices is unaltered, while demand remains spasmodic. The rolling lists issued by the steel mills indicate that production is going forward on a fairly wide scale, and moderately quick deliveries can be got, apart from a certain amount of railway delay. There are inquiries out in connection with the substantial orders for rolling stock which the wagon builders have received. The business accruing is not of sufficient account to relieve the heaviness of the market, however. Several shipbuilding orders lately placed have brought some inquiries and contracts for steel plates. Orders for constructional work are fairly plentiful, and the rail mills are moderately busy. The rates quoted for finished material vary greatly according to specifications, and the circumstances of individual mills. Sellers ask about £7 17s. 6d. for bars, but a good order could be placed at 2s. 6d. less. For Crown quality rolled from English billets £8 5s. is required. Offers of sections at £7 and bridge plates at £7 15s. are numerous. Foreign competition is becoming rather keener for finished material, very low prices being quoted by the continental works. Increasing quantities of exceptionally thin gauges of fine steel strip are called for by the motor and cycle trade, and this business appears to be a promising department, being handled successfully by certain Staffordshire firms. Mild steel billets command £6 to £6 2s. 6d.; continental steel bars are quoted £6 10s., and billets £5 8s. to £5 9s. Steel scrap is selling a little better at £3 10s. delivered. The numerous Birmingham hardware industries are improving customers for several varieties of steel.

Pig Iron.

There has been a further falling off this week in demand for Midland brands of foundry pig iron, but forge qualities have sold a little more readily. Consumers are buying only as much as they are compelled to. With a fair proportion of their output contracted for, furnacemen cling desperately to late quotations. Indeed, on 'Change in Birmingham to-day—Thursday—values showed greater strength than a week ago, when some smelters were slightly shading prices, in spite of a slight easing of coke. Some consultations by the makers of this fuel have led to a reduction of about 9d. per ton. Cheaper fuel is an urgent necessity for trade revival, but for the present the effect of a reduction is to delay buying, users looking for lower pig iron prices. Midland smelters hesitate to accept forward contracts in the present state of labour uncertainty. The prices ruling at to-day's market were :—Northamptonshire forge, £2 17s.; No. 3 foundry, £3 4s. to £3 5s.; Derbyshire, forge, £3 2s. to £3 3s.; No. 3 foundry, £3 7s. 6d. at furnaces. Lincolnshire basic is not in much request. The price asked is £3 5s., but this is regarded by buyers as only the starting point for negotiations. East Coast hematite sold here to-day at about £3 15s. for mixed numbers at furnaces.

Finished Iron.

The slightly improved buying of forge pig iron leads to the assumption that some improvement is taking place in the Staffordshire finished iron trade. The fact that the Midland rolling stock works continue busy may in part account for this moderate improvement in business in wrought iron and re-rolled steel in the Staffordshire area. Nevertheless bar iron prices lack steadiness, except in the marked bar department, in which the basis of £14 is maintained. As regards Crown and common bars the quotations lately ruling have been cut by 5s. There is not a general fall, but ironmasters are prepared to consider offers below the regular prices rather than lose desirable business. Lancashire makers of Crown bars quote £11 and upwards for export orders, the scale varying according to the tonnage and other details affecting the ratio of production costs. Transactions in nut and bolt quality iron have taken place this week at from £10 5s. This department is feeling severely the pinch of foreign competition, buying of Belgian iron, of this class, having taken place at about £6 15s. delivered in the Black Country. Shipments from the Continent are now reported to be coming through with more regularity. Wrought iron gas tube strip commands a fairly ready sale at £12 10s.

Galvanised Sheets.

The galvanised sheet trade is still booking orders freely, practically all, however, being for delivery in April. The Far East and West and South Africa are excellent buyers. Values are strong, the bulk of orders for 24-gauge corrugateds being put through at £16 5s. It is still possible however, to get orders accepted at £16. The black sheet trade is fairly active and prices are firm.

Fuel.

In the industrial fuel market values are weak. An easier tendency is also observable as regards blast-furnace cokes. Contracts over the quarter are a steadying factor for the time being, but Midland smelters are hoping for further relief in that direction.

The Labour Unrest.

Industrialists in the Midlands await developments in the present engineering crisis with great anxiety. The gravity of the position is clearly recognised, but the atmosphere in engineering circles hereabouts is calmer than might be expected. The Midland district, where the motor branch of engineering is enjoying a period of prosperity, is as much likely to suffer as any district from the results of action in which, in the first place, neither the employers nor the workers of the area had any concern.

The Edge Tool Trade.

Edge tool makers in the Midlands and Staffordshire are steadily employed, but they are not working under pressure as they were at the height of the export season a few months ago. Exporters to the East find it necessary to maintain a night shift, though orders have diminished somewhat during the past few weeks. It has been an exceptional period for this branch of the trade. Normally, in the East, there are seasonal holidays and other festivals falling between November and February, which dislocate conditions somewhat, but this year the rubber boom caused a sudden rush of orders which have taxed capacity at this end. There is now evidence, however, that the heaviest demand has spent itself. The Central and South American market, which has been very quiet of late, is now showing signs of improved activity, and makers of edge tools who cater for this market are anticipating increased demands.

Unemployment.

The latest returns issued by the Ministry of Labour disclose a further slight improvement in the unemployment situation in the Midlands. The total number of men, women, boys and girls out of work for the week ended March 1st was 118,054, as compared with 121,320 for the previous week. The number of persons on short time or temporarily unemployed was 35,749, as against 37,078.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

General Outlook.

WITH the prospect of a possible stoppage of the engineering industries of the district looming nearer and nearer, markets have become increasingly gloomy. This atmosphere has, of course, more closely pervaded the iron and steel sections as being the most closely affected by the situation, although it has also to some extent enveloped other markets, which, though only indirectly under the influence of the engineering trades, must in time come within the orbit of any ill-effects which must necessarily follow if a stoppage of work actually takes place. Users of iron and steel are, consequently, not over-anxious to buy now. It is estimated that about 40,000 workers who are members of the unions involved in the dispute, or 10 per cent. of the total all over the country, are employed in the Manchester area.

Non-ferrous Metals.

The situation in France is credited here with having a markedly adverse effect on the non-ferrous metals market, and it is asserted that it has been a contributory factor, at all events, in weakening prices, slight though the weakness has been in most sections. Taking the non-ferrous metals generally, the local demand during the last few days has been only very moderate, and the outlook in the engineering industries is said to have had its influence. The buying of copper here has been at a low ebb. The vagaries of the market for the metal have, of course, to some extent played their part in restricting the demand, but the general state of the copper manufacturing industry has been against active buying. A decided falling off in the cable and wire industries is reported, while in the case of copper sheets and plates the demand has also only been on a moderate scale. There have been fairly heavy arrivals of lead at both Liverpool and Manchester, but business in that metal has been restricted, the cable makers taking a good deal less than they had been doing. Spelter also has attracted comparatively little attention from buyers, the galvanised sheet makers, although moderately active, apparently holding off the market as much as possible. Tin is only in very quiet demand. Although values have receded a little, the statistical position is regarded here as being strongly in favour of still higher levels, once an improvement in the consumption of the metal makes itself felt. As things are at the moment, the supply is barely sufficient to meet the present very limited demand.

Iron.

For the reasons I have already dealt with, the iron market practically throughout the week has been in an exceedingly inactive state. Actual new business has been very quiet indeed, and even inquiry has been of limited extent. Little hope is entertained of an improvement in the position until users can see a reasonably clear way open to them. Most of the producers of pig iron are fairly busily engaged on turning out orders booked a month or two ago. In spite of the restricted business, there is little indication in the iron market at the moment of lower prices. Derbyshire No. 3 foundry iron is still quoted at 75s. to 76s. per ton, while Staffordshire and Lincolnshire makes are offered at round 77s., delivered in Manchester. The quotations for West Coast hematite and Scottish No. 3, also for delivery Manchester or equal are 93s. to 94s. and 95s. per ton respectively. Bar iron is steady at £11 10s. per ton for Lancashire Crown bars and £10 5s. for seconds, delivered in Lancashire, but there is little fresh business moving in these materials. Iron hoops are quiet, but steady at round £14 per ton.

Steel.

In some sections of the steel market values are rather less firm than they have been recently, and there is a disposition on the part of some sellers to shade prices a little compared with recent levels. In this respect plates are perhaps the weakest section. Little actual business has passed in these during the past week, and the market price, delivered Manchester, is now about £7 15s. per ton. For decent sized orders, however, it is said that as low as £7 12s. 6d. per ton would be considered. Angles and joists are also slightly easier at £7 to £7 2s. 6d. per ton, but in other lines there is not much change to record. Steel bars range from £7 12s. 6d. to £7 15s., and ship plates from £7 15s. to £8 per ton. Inquiry, however, is slow in pretty well every department of this market. So far as one can see, there are very few new orders being distributed for constructional steel work at the moment, and whilst in most cases makers are moderately busy on work in hand, jobs are being completed at a faster rate than new business is being received. So far as continental steel is concerned, this meets with little inquiry, and quotations for certain lines are fractionally lower than they were last week. Ordinary billets are round £5 5s. per ton; sheet bars, £5 10s.; joists, £5 17s. 6d. to £6; ship plates, £6 12s. 6d.; Siemens plates, £6 17s. 6d.; and steel bars, £6 7s. 6d. to £6 10s. per ton, prices in each case including delivery in Manchester or equal distance. For British galvanised sheets demand is slow again, India having ceased buying at the moment, and inquiry from the Far East for thin gauges being very limited. Indian plates are fairly steady at about £5 17s. 6d. per ton f.o.b. Black sheets are attracting little attention.

Scrap.

There is some demand for iron and steel scrap, but it is not very pressing, and prices are easy, although not much changed. Mild steel is still quoted at round 55s. per ton, on trucks, in Manchester. Textile machinery cast iron scrap is offered at about 75s. per ton, ordinary machinery cast iron at 70s. to 72s. 6d., and wrought iron at round 70s., delivered to buyers' works. In the non-ferrous section aluminium scrap is rather scarce and firm at £92 per ton, best selected gun-metal at £53, scrap zinc at £24 to £25, heavy copper scrap at £61, lead £32 to £33, and brass rod turnings at £40 to £41, for graded and sorted qualities and including delivery.

Liverpool Engineering Society.

At a meeting of the Liverpool Engineering Society held on the 3rd inst., a paper was read by Mr. W. E. Mills, entitled "Fifty Years of the Liverpool Engineering Society," from which it appears that that body was formed in 1875 by six pupils of the late Mr. George Fosbery Lyster, engineer-in-chief to the Mersey Docks and Harbour Board, under the name of the Liverpool Engineering Students' Society, for the purpose of reading and discussing original communications on engineering subjects. Although the number of members was shortly afterwards increased to eight, it was found impossible for so small a number to keep up a constant succession of papers for weekly meetings, and accordingly in May, 1876, the meetings were arranged to take place fortnightly, and friends of members were invited to join. In the following November the title of the Society was altered by omitting the word "Students," and in February, 1877, a larger place of meeting being required, its headquarters were transferred to the Royal Institute, Colquitt-street. The first President was Mr. C. Graham Smith. By way of illustration of the Society's growth, it may be mentioned that in 1923–24 the number of members was 866, made up as follows :—Honorary members, 4; full members, 505; associate members, 39; associates, 35; and students, 283.

BARROW-IN-FURNESS.

Hematite.

Moderate trade continues in the North-West Coast pig iron market, but it is difficult to gauge in view of possible limitations, due to labour troubles. The threatened engineers' lock-out cannot have a very encouraging effect upon buyers, and the Coal Commission's report and the ensuing deliberations are all calculated to hold certain buyers off. Business is steady on a modified scale, and there is not much iron going into stock unless it is on account of some customer who does not require delivery. There is a certain amount of forward trade being done, but not to the extent that was hoped for. It will be some time before it is possible to say how business is going to settle. The demand is only fair, but it is steady and there are many who expect better things, and yet, on the other hand, some are wondering where the better trade is coming from. There is not much continental trade being done, and as regards America, consumers there only buy at times, and their requirements are for iron of special qualities.

Iron Ore.

The iron ore trade remains in the same condition, with activity not very marked at any of the mines, while other mines are closed for the present. There is not much ore going out of the district to other smelters, and imports of foreign ore are on restricted lines.

Steel.

The condition of the steel trade is not very brisk. Prices are said to be holding off certain buyers, but when that class of buyer expects to get cheaper rails, &c., one wonders. The Barrow mills are engaged still on rails, and the merchants mill is also working, but fresh orders are necessary to keep them going. Workington was working last week on rails and sleepers, but there are not sufficient orders to keep it going continually. The Barrow hoop and small section mills are fairly well off for orders.

The Backbarrow Hydro-electric Scheme.

There is a growing opposition in the town against the Backbarrow hydro-electric scheme, and there have been meetings of objectors. The grounds of opposition are several. It is argued that the terms granted to the present users of the water at the Backbarrow Falls will take all the cream, and, further, it is submitted that there are times when there is not sufficient water to drive one 500-kilowatt turbine. There is to be an inquiry by the Electricity Commissioners in due course.

Orders for Shipbuilding.

There are several rumours about more shipbuilding contracts for Vickers, and an order for a South American cruiser is mentioned. Nothing definite is known here concerning the matter at present, and no doubt if negotiations are proceeding they will be taking place in London. It is hoped that the local yard will secure more orders soon, and thus provide more work for the men at present idle. The cruiser Cumberland will be launched next Tuesday by the Dowager Countess of Carlisle.

SHEFFIELD.

(From our own Correspondent.)

Heavier Steel Trade Quieter.

THE fact that one large melting furnace in the Rotherham area has had to close down is an indication that the position of the heavy crude steel trade is experiencing considerable difficulty in securing enough orders to maintain production on a profitable basis. Very little material is being bought forward, and of late orders have been on the decline from the more favourable position recorded for February. It is hoped that there will not have to be any further curtailment of output, but unless there is an early and definite upward move other furnaces may have to close, for firms cannot afford in these days of financial stringency to manufacture a lot of material for stock. The steel trade generally is variable. Some departments are extremely quiet, but others, chiefly those catering for specialised branches, report that their order books are fairly well filled. Special engineering steel is in request, steel for motor cars is meeting with an increasing sale, and with articles made from stainless material being more widely exploited and proving popular, the output of these departments is being fully cleared. It is only the question of cost that is preventing a much more general use of stainless steel for engineering and domestic uses. In the crucible steel trade a few makers are doing fairly well, but the majority are finding business on the light side. Only a small trade is now being done with France, and the proposed increase of 30 per cent. in the import duties of that country will virtually put an end to Sheffield trade in that direction.

Engineering Work.

Although the private railway plants are receiving numerous orders, they are mostly for small lots, and if the Sheffield shops were working at full capacity they could dispose of them with ease in a short time. The latest order placed by the London, Midland and Scottish Railway Company will be particularly welcome because of the work it will bring to wagon shops, which have had a very lean time for many months. The company's order is for 5800 wagons, 300 underframes, and 50 express locomotives. Firms in the Midlands and the North of England are getting the bulk of the work that is being placed outside—the Derby works of the company are now pretty busily engaged—and among those to benefit are Clayton Wagons, Ltd., Lincoln (500 steel frame merchandise wagons and 250 mineral wagons), Cravens Railway Carriage and Wagon Company, Ltd., Darnall, Sheffield (250 wagons), and the Derbyshire Carriage and Wagon Company, Ltd., of New Whittington, Chesterfield (50 wagons). The announcement is also made that a leading South Yorkshire colliery has placed a contract for the supply of 2000 shipping wagons with a West Riding wagon works. The value of this contract is stated to be about £250,000, and apart from its trade importance, it is significant of the confidence that is felt in the revival of the Yorkshire coal export trade, at present at a low ebb. A large proportion of the steel work for these wagons, such as axles, wheels, buffers, tires and springs, will be made in Sheffield. An order from the London and North-Eastern Railway for a cargo steamer for its cross-Channel services has been placed with Earle's Shipyard, Hull. This firm, by the way, has just completed the last of the eight steamships for carrying grain on the Great Lakes of Canada.

Lighter Steel Trades.

Business in tools and the lighter classes of finished steel continues to be on the decline, though the depression is believed to be only temporary. A good deal of work is known to be pending, particularly from Russia, with which country Sheffield did a good trade last year. At present there is little if any work for Russia in hand in the city, but business is expected to be resumed as soon as the ice breaks at the Russian ports. During the recent Parliamentary discussion on the question of the extension of the export credit system to Russia, Mr. A. V. Alexander, one of the members for the city, stated that last year many British firms had important transactions with the Russian Co-operative Societies, or with organisations licensed to trade by the Soviet, and in every case the bills had been met on the day when they were due. This statement is supported by many Sheffield manufacturers, and the file and tool trades are prepared to give reasonable credit and instalment terms. Mr. A. C. Rouse, head of the South American section of the Overseas Department of the Federation of British Industries, addressing a meeting in Sheffield, said he believed there was a better time coming for Sheffield in South American markets, particularly in edge tools, as there had been a revulsion of feeling against the cheaper goods.

Cutlery and Plate.

There is nothing fresh to report in the cutlery and plate trades, and there is no sign of an end to the depression which has been so marked almost since the beginning of the year. Very little business is coming through the ordinary trade channels, and travellers for Sheffield cutlery and plate firms are having a lean time. Most of the work now in hand is for large, special contracts. Competition in forks, spoons and stainless knives is exceedingly keen, and small makers are undoubtedly forcing prices down. Retail shops are well stocked with foreign goods.

New Type of Tipping Trailer.

A new type of refuse-collecting tipping trailer has been produced by Steel Products, Ltd., Templeborough, and is being given a trial by the Sheffield Corporation. It is a modification of the H.B. trailer, and has been designed with the object of rapidly collecting and discharging refuse. It has a capacity of about three tons, and is built with opposite doors, so constructed that they cannot be opened simultaneously, in order that when one door is opened dust cannot be blown out of the opposite door. The loading line is exceptionally low, and the construction solid. The trailer is mounted on two small wheels, rubber tired, and is fitted with powerful brakes. There is a special tipping device. All the inside rivet heads have been carefully flattened to avoid obstruction of the sliding refuse when the trailer is tipped.

Colliery Topics.

I have referred several times to the developments that are proceeding at Thorne Colliery, where sinking operations were completed last week. It is seventeen years since the undertaking was started, and now the colliery possesses two shafts, both reaching the Barnsley bed and passing through the Kent Thick seam of good quality. Water trouble has been the chief of many serious engineering difficulties that have had to be overcome. Pease and Partners, the owners, have laid out plans for a model colliery village. Lord Gainford, the vice-chairman of the company, giving information about the Thorne development at Doncaster Licensing Sessions, stated that £1,500,000 had been spent in sinking two shafts, and approximately another £1,000,000 in preparation for housing the community which is expected in the colliery village. The position of Hatfield Main Colliery, Stainforth, near Doncaster, is causing considerable anxiety. The loss on the past year's working was no less than £93,483, bringing the total losses to date, as shown in the profit and loss account, to £235,929. The directors state that they are nearly at the end of their capital resources, and promise an account of the exact position at the annual meeting. The output of coal for 1925 was 425,600 tons, against 303,598 tons in 1924, and it is now about 11,000 tons per week. Hatfield Main is a splendidly equipped pit in the new Doncaster coalfield, and the capital expenditure on it has been about £760,000. Sinking was completed in 1917. "Faults" have caused difficulties in the way of developments.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

ALTHOUGH the statistical position of the Cleveland pig iron trade continues strong, market conditions are much quieter, and business is now confined almost entirely to small sales for early delivery. There is still a confident feeling that industrial troubles will be avoided, but the engineering lock-out threat is nevertheless a disturbing factor. A still more serious obstacle to trade, however, is the present range of prices, which consumers contend is too high. On the one hand, makers affirm that even with fuel cheaper, present selling prices of pig iron do not cover the cost of production; whilst, on the other side, are the merchants and consumers who declare that prices cannot continue as they are at present. Certain it is that most of the export trade has been lost; indeed, there is nearly as much foreign iron coming into the river Tees as is being exported. Another disturbing feature is the fact that foreign iron is being dumped in Scotland in large quantities at a price much below that of the Cleveland product. Scotland is regarded as one of Cleveland's best customers, and the loss of business over the Border is a serious matter. However, the makers are absolutely unyielding. They are all adhering rigidly to the fixed prices, and are not unduly anxious for business, as they still have big contracts to execute at current prices. Hence, they can afford to wait, and the "bears" have been unable to influence the market. Cleveland makers are now quoting No. 3 Cleveland iron, f.o.t. Grangemouth, at 75s. per ton, and to other consumers the quotations are unchanged, the following home prices being still subject to an addition of 6d. per ton for export orders:—No. 1 Cleveland, 72s.; No. 3 G.M.B., 70s.; No. 4 foundry, 69s.; No. 4 forge, 68s. 6d.; and mottled and white iron, 68s.

Hematite Pig Iron.

The East Coast hematite pig iron makers have now fairly well overtaken their arrears of deliveries, and seem rather keen to secure renewal of contracts. Here, again, it is difficult to do business with continental buyers, and the Sheffield demand has also rather fallen off. However, makers are still doing a modest amount of business, and are holding to their quotations of 77s. 6d. per ton for mixed numbers, and 78s. for No. 1.

Ironmaking Materials.

Imports of foreign ore continue on a very heavy scale, but new business is rarely heard of. Best Rubio ore is easy at 21s. 6d. per ton, c.i.f. Tees. The coke market is irregular. At the moment there are very few outlets for blast-furnace fuel, and some holders have been selling at a sacrifice. As low as 19s. per ton delivered has, in fact, been done, but some sellers hold out for 20s., and perhaps the middle figure is a fair average.

Manufactured Iron and Steel.

Conditions in the manufactured iron and steel trade leave much to be desired. Prices show no sign of weakening, but buyers are operating very cautiously, and cannot be induced to commit themselves very far ahead. The plate mills, in particular, are slack, but rollers adhere to a quotation of £7 7s. 6d. per ton for steel ship plates. Foreign inquiries do not lead to much actual business.

The Coal Trade.

The Northern coal trade presents few new features of moment. Actual business in most branches is very dull, though there is a slightly better inquiry for the higher grades of steam coal. There is no doubt that buyers are awaiting the issue of the Coal Commission's report. This document may have some effect on prices; consequently, the general disposition is to hold off for the moment. In common with all kinds of fuel, there is little material improvement in best steams, but none the less there is what appears to be a slightly steadier tendency in the position. Prompt orders are in fair numbers, and quotations for the rest of the month are steady at 15s. 9d. to 16s., and only very limited supplies are available at lower figures. Tyne primes and similar large steams are still very quiet at 15s. to 15s. 6d. Seconds are easy at 14s. 6d. The feeling is unsatisfactory for steam smalls generally. Best classes are abundantly available, and easy at 8s. to 8s. 3d., and seconds at 7s. 6d., but specials hold steadily to 10s. to 10s. 6d. No better business is available in the Durham coal trade, and supplies continue to be offered at the recent level of prices. Best gas coals are fairly steady and maintain fully 17s. 6d. to 18s. Secondary gas qualities also seem a little improved at 14s. 6d., and specials keep quietly at 19s. Coking coals are nominal and weak at 14s. to 14s. 6d. Bunkering fuel is similarly at 14s. 3d. for ordinaries and 15s. 6d. to 16s. for other descriptions, and only the immediate position is at all full. With few outlets for coke supplies at the moment, supplies do not grow less heavy, and sellers offer readily at 18s. to 20s. for patent foundry classes and 27s. to 30s. for beehive brands. Gas qualities are steady at 23s.

SCOTLAND.

(From our own Correspondent.)

No Expansion.

TRADE in general continues on recent lines. Shipbuilding orders have given rise to expectations of considerable demands for material of local production, and markets have become more optimistic, but makers may have some time to wait before orders begin to flow. Certainly the number of new vessels ordered is quite unusual, and is still being added to, but there is every probability of keen competition for the material required. Once again no sooner has the trade horizon become a shade brighter than we are faced with the prospect of labour troubles in one or more industries. A settlement will probably be arrived at in due time, but it is hoped that will be accomplished before a considerable amount of business has been lost to foreign competitors. In the meantime, the buying policy was never more "canny," no party being inclined to take the slightest risks.

Pig Iron.

The Scotch pig iron market is a comparatively dull affair; neither home nor export demands are of much importance, and even with restricted outputs stocks in makers' yards are heavy. Prices are comparatively steady.

Steel.

So far as steel plates and sections are concerned, makers find considerable difficulty in securing orders sufficient to maintain even a moderate degree of activity. Keen competition is experienced at home as well as from abroad. Prices are nominally unchanged, though easier terms may be secured for sections, if not for plates. Black and galvanised sheets of the lighter variety are still doing a satisfactory volume of business, especially on export account, and prices of these are firmly maintained.

Iron.

Reports from bar iron makers are not particularly bright, and there is much room for improvement in this department. The re-rolled steel section of this trade is comparatively well placed, however, although the prices obtained in open competition are not very remunerative. Makers have been interested in railway contracts of recent date, and a fair amount of business has been secured but a general all-round improvement is necessary in this industry.

Coal.

The Scottish coal market has been depressed and dull throughout the past week, and is still without any indication of a change for the better, and the downward tendency of prices is unchecked. The collieries continue to press sales of all classes of fuel, which have accumulated owing to the inability of shippers to take delivery, and as present demands are slow, supplies can be secured at prices very advantageous to buyers. Many shippers bought lavishly during January and the first fortnight of February, in anticipation of considerable foreign demands, which unfortunately have not yet been realised. Prices stiffened considerably, but the fuel is being sold to-day at lower prices than those obtained in the first week of January. Sidings are congested by wagons of this unsold fuel, and collieries are selling on the best terms possible. Holders, therefore, are sustaining considerable losses. Aggregate shipments during the past week amounted to 206,103 tons, against 255,432 tons in the preceding week and 231,475 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

Coal Trade Conditions.

FOREIGN coal exports last week showed a reduction upon those of the previous week, but this is not surprising in view of the fact that the supply of tonnage at the disposal of the collieries was by no means plentiful. The conditions were, on the whole, unsatisfactory for many undertakings, and this week started rather badly, inasmuch as there were twenty-three idle loading berths at the various docks on Monday last. Bad weather is responsible for a considerable number of steamers being backward, though it cannot be denied that chartering of late has been rather quieter. The demand is not so active. It is quite true that a fair number of orders are already held by exporters, but new business is hanging fire, and it is evident that the tendency all round is to wait, partly for the purpose of seeing what happens when the Coal Commission's report is issued, and partly because the belief is entertained that lower prices are likely to prevail. According to their books, most of the leading collieries are pretty fully sold for this month, but in some instances it may be that their contractors have not so far placed their coals with buyers abroad. No new inquiries of any note have come on the market of late, but so far as the tenders for the order of just over 30,000 tons of best Admiralty large coals for the Palestine Railways are concerned, it is stated that the business has been placed, though details are lacking. The coals have to be delivered at Haifa in six cargoes. From what can so far be ascertained, the business has not been taken by a local firm.

Barriers to British Coals.

Quite apart from the uncertainty and anxiety regarding the coal trade from the point of view of events at home, there have been developments abroad which cause some uneasiness to those directly engaged in the export side of the industry. For some time past the Spanish mineowners have been using their influence upon their Government to adopt measures to assist them, and the outcome is that towards the end of February the Spanish Government issued a decree, which, if it becomes really effective, will have the effect of cutting down the import of British coal into Spain by 50 per cent. This decree provides that the Spanish Railways are to consume native coals exclusively, with the exception of 15 per cent. imported coal if they run express trains and 10 per cent. if they do not. All Spanish metallurgical industries, cement factories, sugar factories, &c., are to consume 80 per cent. Spanish coal and 20 per cent. of imported coal. All other industries which are protected by the present tariff—which practically means all industries—are to use 50 per cent. Spanish coal. Gas companies are to use Spanish coal exclusively, and electricity works 80 per cent. Spanish coal. The supply of coal from floating coal hulks and free depôts is restricted to ships which are engaged in trans-oceanic voyages. All coasting vessels are to use Spanish coals exclusively, and Spanish and foreign ships which trade between European and Mediterranean ports are prohibited from taking any foreign coal in Spanish ports, even if the duty is paid. The decree is regarded very seriously, and representations are being made to the Foreign Office through the Mines Department by the Coal Exporters' Federation. There have also been rumours that another continental country contemplates imposing a tax on imported coals and patent fuel, which, if it takes effect, will have a very detrimental result upon the patent fuel industry of Swansea. Further news is awaited with interest, but it is evident that there is urgent need of the British Government watching such developments, which are aimed at injuring the coal trade, and taking active steps to safeguard the interests of producers and exporters in this country.

South Wales Coalowners' Association.

At the annual meeting of the South Wales Coalowners' Association at Cardiff on Monday last, Mr. E. L. Hann was appointed Chairman for the ensuing year and Mr. W. Johnston was elected Vice-chairman. Mr. Hann is the general manager of the Powell Duffryn Company's undertakings in this district. The statement presented by the secretary showed that the output of the members for 1925 was 41,801,089 tons, which was less by 5,030,390 tons than in 1924, equal to 10·65 per cent.

Cardiff Corporation and Belgian Tender.

Reference was made last week to the fact that the Cardiff Electricity Committee had decided to recommend the Council to accept the tender of a Belgian firm for the supply of low-tension paper-insulated cables, the reason being that the tender was £2188 below the lowest British tender. The City Council on Monday decided to refer the matter back to the Committee, the view being expressed that work should not go out of the country in the present state of unemployment. It was stated that letters had been received from some of the English firms offering to revise their contracts to keep the work in this country.

Swedish Railways Inquiry.

The Swedish Railways are in the market for 68,000 tons of locomotive coal for delivery April to June.

Tin-plate Trade Wages.

The Joint Standing Committee of the Tin-plate Joint Industrial Council failed on Tuesday to come to a decision regarding the men's proposal for a change in the basis of the sliding scale.

Coal Shifts.

Sir Felix Pole, the general manager of the Great Western Railway, and other officials have arranged to meet the trimmers and tippers at South Wales ports on Thursday, 18th inst., to discuss the question of a revision of the existing working shifts.

Current Business.

The tone of the market has again been irregular, and the volume of business has been comparatively small, Owing to the inadequacy of ready tonnage, many collieries have been in difficulties in keeping their pits working without interruption, and as the result prices of coals, both large and small have suffered for spot shipment. Very few buyers, however, have been in a position to take advantage of the reduced values. For delivery ahead colliery salesmen are not prepared to make concessions, as they have fairly full order books, and tonnage which has been delayed by the bad weather is due to come along. Pitwood remains firm as the strike at the French Bay ports has not terminated. Anthracite coals are not so steady for shipment this month, but an improvement is looked for in April, when shipments are to be resumed to Canada.

LAUNCHES AND TRIAL TRIPS.

NORTHLAND, single-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of the Clarke Steamship Company, Ltd.; dimensions, 300ft. by 47ft. beam. Engines, triple-expansion; constructed by the builders; launch, January 29th.

CITY OF LYONS, single-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of the Ellerman Lines, Ltd.; to carry 11,300 tons. Engines, Parsons impulse reaction type turbines and single reduction mechanical gearing: constructed by the Wallsend Slipway and Engineering Company, Ltd.; trial trip, February 3rd.

OLIVEBANK, twin-screw motor vessel; built by Harland and Wolff, Ltd., to the order of Andrew Weir and Co. (Bank Line, Ltd.); dimensions, 434ft. by 53ft. 9in. by 37ft.; 5200 gross tonnage. Engines, Harland-B. and W. motors; constructed by the builders; trial trip, February 9th.

GEORGE L. TORIAN, steamer; built by Earle's Shipbuilding and Engineering Company, Ltd., to the order of the Eastern Steamship Company, Ltd.; dimensions, 258ft. by 44ft. by 20ft.; 2510 tons deadweight. Engines, triple-expansion, surface condensing, 17in., 28in., 46in. diameter by 33in. stroke, pressure 180 lb.; constructed by the builders; trial trip, February 11th.

BELRAY, single-screw cargo vessel: built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of Captain Christen Smith; dimensions, 328ft. 9in. by 46ft. by 23ft. 3in.; to carry 4280 tons. Engines, single-screw Armstrong-Sulzer Diesel, two-cycle type; constructed by the builders; launch, February 15th.

JOHN S. PILLSBURY, steamer; built by Earle's Shipbuilding and Engineering Company, Ltd., to the order of the Eastern Steamship Company, Ltd., of Canada; dimensions, 258ft. by 44ft. by 20ft.; 2510 tons deadweight. Engines, triple-expansion, surface-condensing, 17in., 28in., 46in. diameter by 33in. stroke, pressure 180 lb.; constructed by the builders; launch, February 25th.

SPEYBANK, motor vessel; built by Harland and Wolff, Ltd., to the order of the Bank Line, Ltd.; dimensions, 434ft. by 53ft. 9in. by 37ft. Engines, six-cylinder Harland-B. and W. motors; constructed by the builders; launch, February 25th.

CONTRACTS.

THE SIEMENS AND ENGLISH ELECTRIC LAMP COMPANY, Ltd., asks us to state that Siemens electric lamps are fitted throughout the Royal Mail Steam Packet Company's motor liner Asturias.

VICKERS LTD. inform us that two sets of their 600 horse-power Diesel engines are to be fitted in two vessels, each of 1500 tons gross register, which the Osaka Shosen Kaisha (Osaka Mercantile Steamship Company, Ltd.) has ordered to be constructed by the Mitsubishi Zosen Kaisha, at its Kobe Shipyard.

JAMES GORDON AND CO., Ltd., Windsor House, Kingsway, W.C. 2, have during the last two months received orders for over seventy equipments of Copes automatic feed-water regulators, amongst them being eight for the Oldham Electricity Works and eight for Synthetic Ammonia and Nitrates Company, besides a number for export.

THE N.V. INTERNATIONALE SCHEEPSBOUWMIJ "DE MAAS," of Slikkerveer, Holland, the agents for which in this country are J. B. Forster and Co., of Billiter Square-buildings, London, E.C. 3, has received orders to build four cargo and passenger steamers for service in the Borneo coasting trade. Dimensions of vessels will be 299ft. 10½in. long by 45ft. 11in. beam and 17ft. deep.

THE GENERAL ELECTRIC COMPANY, Ltd., Magnet House, Kingsway, London, W.C. 2, has received the following orders for tramway motor equipments:—For Bury Corporation Tramways, sixteen 46 horse-power motors and auxiliary gear; for Leeds City Tramways, eighty 70 horse-power motors and auxiliary gear; and for Manchester Corporation Tramways, fifty 50 horse-power motors.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

FERGUSON SUPERHEATERS, Ltd., 3–4, Clements Inn, London, W.C. 2, has been appointed sole selling agent in the London district by Quantameters, Ltd., for the latter's remote tank level and flow indicators, &c.

MESSRS. CARTERS Shipping Department ask us to announce that they have removed from 5, Moorgate, and 3 and 4, Lothbury, London, E.C. 2, to 6, Princes-street, London, E.C. 4. Their telegraphic address will remain unaltered, but their new telephone number will be Central 3938.

MR. R. H. CAMPION, chief engineer of the electricity and tramway undertakings of the Chesterfield Corporation, has been appointed manager and engineer of the Torquay tramways, in succession to Mr. H. J. Nisbett, who has retired. Mr. Campion will take up his new duties early this month.

WALKER, CROSWELLER AND CO. ask us to announce that they have moved from Dane's Inn House, 265, Strand, W.C. 2, to 54–58, Queen Elizabeth-street, London, S.E. 1. Their telegraphic address has been modified to "Instrukemi, Boroh, London," and their new telephone number is Hop 5786.

MR. H. J. YOUNG, F.I.C., has resigned his position as chief chemist to the North-Eastern Marine Engineering Company, Ltd., Wallsend-on-Tyne and Sunderland, and has opened an office at 3, Central-buildings, Westminster, London, S.W. 1, where he will practise as a consulting metallurgist and works chemist.

WILLIAM BEARDMORE AND CO., Ltd., ask us to state that they have appointed Squadron Leader de Haga Haig as "outside" manager in connection with their aviation and aero-engine departments. Squadron Leader Haig will be responsible for tests, equipment and delivery of aircraft and aero-engines, and will act as *liaison* official between the company and its clients in connection with the completion and delivery of each contract.

A. HARPER, SONS and BEAN, Ltd., of Dudley, Worcs., ask us to announce that Mr. H. Kerr Thomas, who is President of the Institution of Automobile Engineers and was formerly resident director of Associated Equipment Company, Walthamstow, has been appointed general manager of the Dudley firm. Messrs. Harpers also desire us to state that Hadfields, Ltd., of Sheffield, has acquired a controlling interest in their company.

MAXTED AND KNOTT, Ltd., of 23, Queen Anne's-gate, Westminster, S.W. 1, ask us to announce that Mr. F. Knott, one of the founders of the firm, has decided to retire from active practice after thirty-four years' of continuous service with the company. Mr. Knott does not propose to take any active part in the details of the business, but will retain a financial interest in it, and will continue to take an advisory part in its affairs. Mr. E. G. Walker, of Westminster, who has co-operated with Maxted and Knott, Ltd., on various occasions during the past seven years in connection with some of the works which the firm has carried out, both in this country and abroad, has joined the firm on the retirement of Mr. Knott. His own practice has been incorporated with that of the firm. Maxted and Knott, Ltd., will continue to occupy their present temporary head offices at Dunstable and to have their registered London offices at 23, Queen Anne's-gate, Westminster, as heretofore.

CATALOGUES.

DONOVAN AND CO., 41, Cornwall-street, Birmingham.—Booklet describing "Safuse" industrial panels.

THE UNITED STEEL COMPANIES, Ltd., Sheffield.—Lists of products and the addresses of works and district offices.

NORRIS, HENTY AND GARDNERS, Ltd., Patricroft, Lancs.—Catalogue describing the T type vertical heavy oil engine.

GEORGE KENT, Ltd., Biscot-road Works, Luton.—Publication No. 695, describing Kent's "M" type uniform water meter.

THE NORTON COMPANY, Worcester, Mass., U.S.A.—Booklet entitled "Artificial Abrasives: Their History and Development."

JOHN DAVIS AND SON (DERBY), Ltd., All Saints' Works, Derby.—Folder dealing with the "Derby" garage lamp, made to burn either paraffin or petrol.

EVERSHED AND VIGNOLES, Ltd., Acton-lane Works, London, W. 4.—Two new publications, entitled "Modern Recorders" and "The M.E.G. Insulation Tester."

RICHARD GARRETT AND SONS, Ltd., Aldwych House, Aldwych, W.C. 2.—Booklet No. 620, entitled "Proof," containing descriptive information of the "Garrett" undertype lorry.

THOMAS ROBINSON AND SON, Ltd., Railway Works, Rochdale.—Instruction booklet dealing with the operation and maintenance of the "Universal Woodworker," Type C.I.

THE MIRRLEES-WATSON COMPANY, Ltd., Scotland-street, Glasgow.—Pamphlet, describing the surface condensing plant at the mills of the Braidwater Spinning Company, Ltd.

E. BENNIS AND CO., Ltd., 28, Victoria-street, London, S.W. 1.—Booklet, describing the "Bennis" stoker and self-cleaning furnace, entitled "Cheap Steam and Machine Firing."

THE REES ROTURBO MANUFACTURING COMPANY, Ltd., Wolverhampton.—Circular R 228, giving illustrations and descriptions of the various types of pumps manufactured.

THE ENGLISH ELECTRIC COMPANY, Ltd., Queen's House, Kingsway, W.C. 2.—Price List No. 2071 of oil-immersed switch fuses; also Publication No. 568 on induction regulators, Class X.R.

THE RAPID MAGNETTING MACHINE COMPANY, Ltd., Lombard-street, Birmingham.—Booklet illustrating and describing the various types of separators, chucks, magnets, &c., made by the company.

THE IGRANIC ELECTRIC COMPANY, Ltd., 147, Queen Victoria-street, E.C 4.—Leaflet No. 920, describing A.C. hand-operated oil-immersed starters; leaflet No. 925, describing A.C. hand-operated air-break starters.

THE WESTINGHOUSE BRAKE AND SAXBY SIGNAL COMPANY, Ltd., 82, York-road, N. 1.—Catalogue S. 12, describing position light signals; also catalogue S. 1002, entitled "The Resignalling of the Mersey Railway."

WAR OFFICE MOTOR LAUNCHES.—Two motor launches were recently completed for the War Office. They were built by Hugh McLean and Sons, of Glasgow, and engined by the Parsons Motor Company, Ltd., of Southampton. One of them, the Sir John Asser, will be used at Bermuda, and the other, the Sir Leslie Rundle, will be stationed at Malta. They are 34ft. ships with a beam of 8ft. and a draught of 2ft. 6in. The plans indicate that they are designed for harbour work in fairly rough water. The machinery comprises a 50 brake horse-power six-cylinder Parsons petrol motor installed amidships, designed for a boat speed of 12 miles per hour. At the official trials the steering and handling of the boats was shown to be particularly good, a complete circle at full speed was made in 45 seconds, whilst only 5 seconds were required, we are informed, between full speed ahead and dead stop. The order for these boats was placed in the late autumn and they were delivered to contract time in February.

A NOTABLE DINNER.—"The Joint Delegation" is a local name for a body which is engaged in the very laudable task of bringing the members of a group of five institutions together. It was established not long since in Leeds, largely through the foresight and energy of Lieut.-Colonel Kitson-Clark, and it includes the Yorkshire Associations of the Institution of Civil, Mechanical, Electrical, Municipal and County and Locomotive Engineers. It is one of the most promising attempts to unite engineers who are following different branches of the profession for their common good. It is generally agreed that the system of water-tight compartments has the defects of its merits; it tends to narrow men by excessive specialisation. The Joint Delegation may, to carry on the hydraulic analogy, be regarded as a common sump from which all can draw. At its foregatherings members of the five institutions whose names we have given meet together and a library common to all is already making progress. On Friday, March 5th, it held in the Great Northern Hotel, Leeds, its first dinner. In all there were perhaps sixty diners, under the chairmanship of Mr. J. H. Barker, who in a weighty and thoughtful speech, in which he spoke with much seriousness of the present industrial trouble, proposed the health of the engineering profession. Mr. Loughnan Pendred responded. A novel toast, that of Yorkshire towns, was then admirably proposed by Mr. W. B. Woodhouse, and felicitously acknowledged by Mr. S. Derwen Jones. Mr. G. A. Hart called upon the company to drink the health of the Joint Delegation, and Lieut.-Colonel E. Kitson-Clark responded. None of the speeches were long, and they all had something of that lightness of touch which is so desirable during the process of digestion. Altogether a very happy evening.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
Native	21/-
(1) Spanish	18/6
(1)N. African	18/6
N.E. COAST—	
Native	—
Foreign (c.i.f.)	21/3

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 17 0	—
No. 1 Foundry	3 19 0 to 4 1 6	
No. 3 Foundry	3 16 6 to 3 19 0	
N.E. COAST—		
Hematite Mixed Nos.	3 17 6	3 17 6
No. 1	3 18 0	3 18 0
Cleveland—		
No. 1	3 12 6	3 13 0
Silicious Iron	3 12 6	3 13 0
No. 3 G.M.B.	3 10 0	3 10 6
No. 4 Foundry	3 9 0	3 9 6
No. 4 Forge	3 8 6	3 9 0
Mottled	3 7 6	3 8 0
White	3 7 6	3 8 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	10 10 0	—
North Staffs. Forge	3 17 6	—
,, ,, Foundry	4 7 6	—
(3) Northampton—		
Foundry No. 3	3 4 0 to 3 5 0	
,, Forge	2 17 0	—
(3) Derbyshire—		
No. 3 Foundry	3 7 6	—
Forge	3 2 0 to 3 3 0	
(3) Lincolnshire—		
No. 3 Foundry	3 8 0	—
No. 4 Forge	3 5 6	—
Basic	3 6 0	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 10 0 (*a*) / 4 12 6 (*b*) / 4 17 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	11 5 0	—
Best	—	—
N.E. COAST—		
Common Bars	11 0 0	—
LANCS.—		
Crown Bars	11 10 0	—
Second Quality Bars	10 5 0	—
Hoops	14 0 0	—
S. YORKS.—		
Crown Bars	12 10 0	—
Best ,,	13 10 0	—
Hoops	14 10 0	—
MIDLANDS—		
Crown Bars	11 0 0 to 12 0 0	
Marked Bars (Staffs.)	14 0 0	—
Nut and Bolt Bars	10 5 0 to 11 0 0	
Gas Tube Strip	12 10 0	—

STEEL.

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	11 0 0	—
Ship Plates, ½in. and up.	7 10 0	—
Sections	7 0 0	—
Steel Sheets, under 3/16in. to ½in.	9 0 0	—
Sheets (Gal. Cor. 24 B.G.)	—	£17 to £18

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	7 7 6	—
Angles	7 0 0	—
Boiler Plates	11 10 0	—
Joists	7 0 0	—
Heavy Rails	8 0 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	8 2 6	—
Soft Billets	7 5 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 0 0†	—
Light ,,	8 5 0 to 8 10 0	
Billets	7 10 0 to 9 0 0†	
MANCHESTER—		
Bars (Round)	8 0 0 to 8 5 0	
,, (others)	8 0 0 to 8 5 0	
Hoops (Best)	13 5 0	13 0 0
,, (Soft Steel)	10 0 0	9 15 0
Plates	7 12 6	—
,, (Lancs. Boiler)	11 10 0	—
SHEFFIELD—		
Siemens Acid Billets	10 10 0	—
Bessemer Billets	11 5 0	—
Hard Basic	8 12 6	—
Intermediate Basic	8 2 6	—
Soft Basic	6 15 0 to 7 0 0	
Hoops	12 0 0	—
Soft Wire Rods	9 10 0	—
MIDLANDS—		
Small Rolled Bars	7 17 6 to 8 0 0	
Billets and Sheet Bars	6 0 0 to 6 2 6	
Sheets (20 W.G.)	11 10 0 to 12 0 0	
Galv. Sheets, f.o.b. L'pool	16 0 0 to 16 5 0	
Angles	7 0 0 to 7 5 0	
Joists	7 0 0 to 7 5 0	
Toes	8 2 6 to 8 5 0	
Bridge and Tank Plates	7 17 6 to 8 0 0	
Boiler Plates	11 0 0 to 11 10 0	

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	19/3 to 19/6
Block Tin (cash)	292 7 6
,, (three months)	282 15 0
Copper (cash)	59 0 0
,, (three months)	60 0 0
Spanish Lead (cash)	31 12 6
,, (three months)	31 17 6
Spelter (cash)	34 11 3
,, (three months)	34 11 3
MANCHESTER—	
Copper, Best Selected Ingots	64 10 0
,, Electrolytic	67 0 0
,, Strong Sheets	90 0 0
,, Tubes (Basis Price)	0 1 1
Brass Tubes (Basis Price)	0 1 0
,, Condenser	0 1 2½
Lead, English	33 15 0
,, Foreign	32 10 0
Spelter	35 15 0

FERRO ALLOYS.

(*All prices now nominal.*)

	Per Ton.	Per Unit.
Tungsten Metal Powder	2/1 to 2/2 per lb.	
Ferro Tungsten	1/11 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£22 10 0	7/6
,, 6 p.c. to 8 p.c. ,,	£22 5 0	7/3
,, 8 p.c. to 10 p.c. ,,	£20 15 0	7/-
,, Specially Refined		
,, Max. 2 p.c. carbon	£39 0 0	14/-
,, ,, 1 p.c. ,,	£45 0 0	14/6
,, ,, 0·70 p.c. carbon	£55 0 0	17/6
,, ,, carbon free	1/5½ per lb.	
Metallic Chromium	3/3 per lb.	
Ferro Manganese (per ton)	£15 for home, £15 for export	
,, Silicon, 45 p.c. to 50 p.c.	£11 15 0	scale 5/- per unit
,, ,, 75 p.c.	£21 0 0	scale 6/- per unit
,, Vanadium	14/- to 15/- per lb.	
,, Molybdenum	6/- per lb	
,, Titanium (carbon free)	1/- per lb.	
Nickel (per ton)	£172 to £175	
Cobalt	10/- to 11/- per lb.	
Aluminium (per ton)	£120	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	14 6
,, ,, Ell	15/-
,, ,, Splint	16/- to 18/-
,, ,, Trebles	15/1½
,, ,, Doubles	12/9
,, ,, Singles	12/-
AYRSHIRE—	
(f.o.b. Ports)—Steam	15/6
,, ,, Jewel	16/6
,, ,, Trebles	15/9
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	12/6 to 14/10½
Screened Navigation	21/-
Trebles	15/- to 17/6
Doubles	12/3
Singles	12/-
LOTHIANS—	
(f.o.b. Leith)—Best Steam	13/10½
Secondary Steam	13/3
Trebles	14/6
Doubles	13/-
Singles	12/3

ENGLAND.

(8) N.W. COAST—	
Steams	24/6
Household	40/- to 48/-
Coke	26/-
NORTHUMBERLAND—	
Best Steams	15/6 to 16/-
Second Steams	14/6
Steam Smalls	8/- to 8/6
Unscreened	14/-
Household	20/- to 22/-
DURHAM—	
Best Gas	17/6 to 18/-
Second	14/6 to 15/-
Household	20/- to 22/-
Foundry Coke	18/- to 20/-
SHEFFIELD—	Inland.
Best Hand-picked Branch	31/- to 34/-
Barnsley Best Silkstone	28/- to 30/- —
Derbyshire Best Brights	26/- to 28/- —
,, ,, House	24/- to 25/- —
,, ,, Large Nuts	17/- to 20/- —
,, ,, Small	12/6 to 14/- —
Yorkshire Hards	17/- to 19/6 —
Derbyshire ,,	16/- to 19/- —
Rough Slacks	10/- to 12/6 —
Nutty ,,	7/6 to 9/- —
Smalls	3/6 to 6/- —
Blast-furnace Coke (Inland)*	— —
,, ,, (Export)	f.o b. 16/6 to 17/6

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	23/- to 24/-
Second ,, ,,	21/6 to 22/6
Best Dry Large	21/- to 22/-
Ordinary Dry Large	19/- to 20/-
Best Black Vein Large	20/6 to 21/6
Western Valley Large	20/- to 20/6
Best Eastern Valley Large	20/- to 20/6
Ordinary ,, ,,	19/- to 20/-
Best Steam Smalls	12/- to 12/6
Ordinary ,,	11/- to 12/-
Washed Nuts	19/- to 20/-
No. 3 Rhondda Large	27/- to 27/6
,, ,, Smalls	15/6 to 16/-
No. 2 ,, Large	19/6 to 20/6
,, ,, Through	16/- to 17/-
,, ,, Smalls	10/6 to 11/-
Foundry Coke (export)	37/6 to 40/-
Furnace Coke (export)	25/- to 30/-
Patent Fuel	20/- to 22/6
Pitwood (ex ship)	40/- to 42/6
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	39/6 to 41/-
Seconds	30/- to 32/6
Red Vein	27/- to 29/-
Machine-made Cobbles	50/- to 52/6
Nuts	50/- to 52/6
Beans	41/- to 43/-
Peas	21/- to 24/-
Breaker Duff	7/- to 7/6
Rubbly Culm	9/- to 10/-
Steam Coals:	
Large	22/- to 23/-
Seconds	20/- to 22/-
Smalls	9/- to 10/-
Cargo Through	16/- to 17/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. * For blast-furnaces only, 17/-, with fluctuations according to analysis; open market, 17/6 to 19/- at ovens. † Latest quotations available. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham.

French Engineering Notes.

(From our Correspondent in Paris.)

A European Commercial League.

In November last Mr. Walter Leaf, president of the International Chamber of Commerce, made a statement to the effect that the commercial and industrial prosperity of France was illusory, simply because the country was living upon a reserve of stocks of raw material, and he affirmed that as soon as those stocks were depleted the balance of trade would take an unfavourable turn. Events proved the correctness of this view much sooner than had been expected, and the situation is causing considerable uneasiness, despite the fact that production continues to increase. Judging from the returns of foreign trade since November, the depreciation of the franc has had the effect of increasing the cost of imported raw material by 75 per cent., while the cost of exported goods has only increased 15 per cent. Production costs must necessarily advance, and prices on the home market are already rising, with the result that higher prices will have to be asked for export. If, therefore, France is to be saved from an economical disaster, she must follow the example of Italy and Belgium and stabilise her currency at whatever cost to herself, and there can be no hope for the future unless the country resolutely undertakes a prompt solution of a financial problem which will allow of credit being restored. In another address to the Council of the International Chamber of Commerce, Mr. Walter Leaf remarks upon the progress that has been made by all countries except France, and shows that the production capacity exceeds the pre-war figure, while the consumption has diminished, and this he attributes to the restrictions upon international trade due to inflated tariffs and other causes. Mr. Walter Leaf therefore suggests that the only way to insure a general prosperity is to follow the conditions in the United States and create a commercial league which will insure a free market throughout Europe and stimulate consumption by an organisation of production and distribution, which will also permit of a lowering of production costs.

Motor Fuels.

If the exhaustive experiments being carried out in Paris should give definitely satisfactory results, an entirely new field of research may be opened up for the production of cheap motor fuels. Two cars are now being run at the Montlhéry Autodrome for testing a fuel consisting of about 65 per cent. of benzol, 25 per cent. of gas oil, and 10 per cent. of schist oil, which is contained on the petrol tank and passes through the carburetter in the usual way. Adjoining the carburetter is a small apparatus for mixing acetylene with the sprayed oil. The success of the fuel depends naturally upon supplying the exact proportion of acetylene to oil. The tests are being made with a 70 by 105 four-cylinder Buc car and a 72 by 120 four-cylinder Renault. Running first on petrol the Buc consumed 13·26 litres per 100 kiloms. and the Renault 11·16 litres. With the new fuel the consumptions per 100 kiloms. were, for the Buc, 6·66 litres of oil and 332 litres of acetylene, and, for the Renault, 8·3 litres of oil and 334 litres of acetylene. In one case the economy in liquid fuel was 50 per cent. and in the other 25 per cent. This discrepancy is attributed to the crude nature of the apparatus employed. Taking the cost of petrol at 2·3 f. per litre, the "diluting" oil at 1·8 f., and acetylene at 10 f. per cubic metre, it was found that the Buc consumed petrol to the value of 30·498 f. per 100 kiloms., while the mixture of oil and acetylene cost only 15·308 f. In the case of the Renault the petrol cost was 25·668 f. and the cost of oil and acetylene 18·28 f. Dissolved acetylene was employed for the trials, and if acetylene were supplied by a small generator the cost would be appreciably less.

The Port of Nantes.

The works which have been carried out for many years past to regularise the Loire, mainly with masses of interlaced brushwood and other material solidly staked to the bed on each side of the river to narrow and deepen the channel in the shifting sands, have considerably lessened the risks of floods at the port of Nantes, but another serious trouble is the gradual undermining of the port itself, whereby the wharves, bridges and other constructions have been weakened to the extent that they constitute a perpetual danger. The programme for consolidating and extending the port was authorised in 1913, and since the Armistice the works have been well advanced, notably the construction of the Wilson Wharf, which will soon have a length of 1560 m. One half of the wharf is carried on arches and one quarter on reinforced concrete piles. Two other wharves are being constructed of reinforced concrete, and will be finished by the end of the year. The old Pirmil Bridge, which collapsed nearly two years ago, has been replaced by a metallic structure, and it has been decided to replace the Madeleine Bridge by one of reinforced concrete. It will have three arches with a total length of 155 m. and a width of 15 m. What has already been done is only the beginning of an extensive scheme of reconstruction, which has been rendered necessary not only by the general dilapidated state of the old wharves and bridges, but also by the necessity of equipping Nantes with everything necessary to deal with the increasing tonnage, which it is expected will follow upon the execution of the scheme to render the Loire navigable.

Colonial Works.

As there is no possibility of obtaining credits or of raising money in this country for the execution of the vast programmes of public works which have been prepared in the Colonies, arrangements are being made for the Colonies themselves to provide the necessary funds. In Senegal the budget for the present year provides for an expenditure of 23 million francs on public works, principally railways, roads and bridges, port equipment, hydraulic works and sanitation. A sum of two million francs is to be devoted to the purchase of plant and machinery. In Madagascar an extensive scheme of railway, road, and hydro-electric construction is to be put in hand at an estimated cost of 200 million francs.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

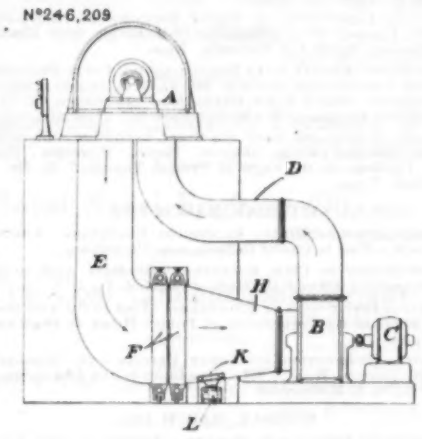
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

246,209. October 21st, 1924.—IMPROVEMENTS IN AND RELATING TO THE VENTILATION OF DYNAMO-ELECTRIC MACHINERY, TRANSFORMERS AND THE LIKE, The Hon. Sir Charles Algernon Parsons and Jessel Rosen, both of Heaton Works, Newcastle-on-Tyne.

The drawing shows the invention applied by way of example to a turbine-driven alternator A. A fan B, driven by any suitable motor C, forces air—as shown by the arrows—through an appropriate duct D to the alternator, whence it issues by way of a duct E of increased cross-section to one or more main coolers F F, the cooled air then passing through the converging duct H to the intake of the fan in order to be re-circulated. Within this duct H, and preferably behind the main cooler or coolers

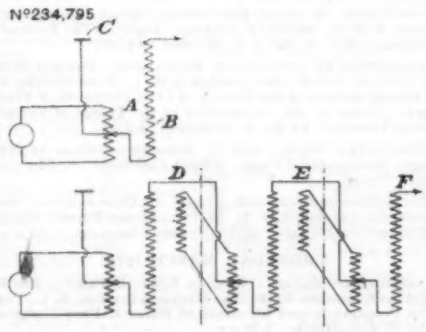


F F, in the direction of the flow of air, a small auxiliary cooler or condenser K is provided, separate from the main coolers, the temperatures of the main and auxiliary coolers being adjusted with regard to the dew point to give the essential result sought, namely, to cool in the main cooler and to cool and condense in the auxiliary cooler. Only a small portion of the circulating air passes through or over the auxiliary cooler, which is placed in a position where the air is at a low velocity. In addition, baffle plates may be provided to prevent the condensate from being swept into the ducts by the flow of air. Condensation being thus localised in the auxiliary cooler, the condensate may be collected in a trap L or other convenient device and drained off from the air system.—*January 21st*, 1926.

TRANSFORMERS AND CONVERTERS.

234,795. April 30th, 1925.—TRANSFORMER WINDING FOR VERY HIGH VOLTAGES, Maschinenfabrik Oerlikon, of Oerlikon, near Zurich, Switzerland.

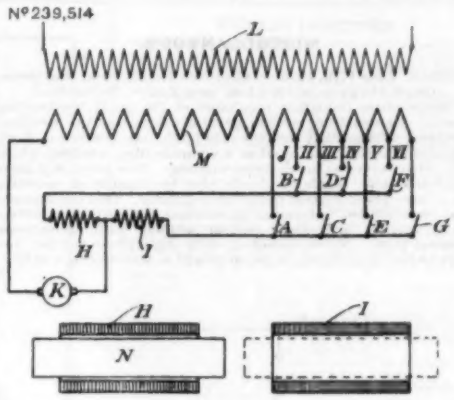
In high-tension electric transformers and particularly in transformers in which the iron core is insulated from earth, whilst one pole of the high-tension winding is earthed, it is frequently observed that charge phenomena occur on the low-tension side, and lead to flash-overs between the in-leads of the low-tension winding, in spite of one pole of the high tension being earthed. The cause of this phenomenon is mainly due to the fact that the capacity current in the low-tension winding can only flow unhindered in the direction of the earthed conductor, whilst it encounters resistance in the other conductor. The present invention aims at avoiding the above phenomenon by a suitable arrangement of the low-tension winding in such a manner that capacity currents set up therein are enabled to escape and are rendered harmless. A denotes the low-tension winding and B the



high-tension winding, both of which are distributed in the well-known manner over the iron core of a transformer. The middle point of the low-tension winding A is connected to one end of the high-tension winding B and is earthed at C. The capacity current generated in the low-tension winding A is thus able to flow, without hindrance, from both halves of the winding to the middle point of the low-tension winding, which is connected to earth, and to set up in the iron core a magnetic field corresponding to the magnitude of the leakage due to the windings. The low-tension winding may be subdivided axially or radially into two or more coils traversed by the current in the same sense and wound on the same core, in which case the leakage can be reduced to a practically incommensurable value in relation to the capacity current. The arrangement shown in the upper diagram may also be advantageously employed for intercoupled transformers, as is illustrated diagrammatically for the three transformers D, E and F in the lower diagram.—*January 28th*, 1926.

239,514. September 2nd, 1925.—IMPROVEMENTS IN AND RELATING TO CHOKING-COIL SWITCHES FOR STEP TRANSFORMERS WITH CONTINUOUS REGULATION. *International General Electric Company, Incorporated, of 120, Broadway, New York, United States of America.*

The upper diagram shows a step transformer with the primary winding L and the secondary winding M, which feeds a motor K. By means of the switches A to G, the two series-connected choking coils H and I can be alternately connected to the switch steps 1 to 6. If, for example, the switches A and B are closed, the motor K is driven with current from the step I. If it is desired to change over to the second switch step, the switch A is opened and the switch C closed. The lower illustration shows the choking coils H and I with the displaceable iron core N. If the

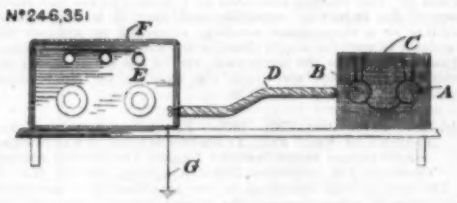


core N is situated in the coil H, the load current flows through the switch A and the coil I, while the switch B and the coil H are practically dead. If, now, the core N is pushed into the coil I, the current in the coil H gradually increases, and falls in the coil I in a corresponding manner until the core is completely pushed into the coil I, when the entire current flows in coil H. Simultaneously, the pressure on the motor K has gradually increased by the voltage of the step I. The switch A can now be opened in a dead condition and the switch C closed dead. The same action with step 2 can then be commenced. If the opening and closing of the switches and the displacement of the iron core is positively controlled in a suitable manner, a continuous regulation of the supply voltage results almost without any interruption of current. There are three other illustrations.—*January 28th*, 1926.

TELEGRAPHS AND TELEPHONES.

246,351. April 3rd, 1925.—SHIELDING MICROPHONES AND ASSOCIATED AMPLIFIER APPARATUS, *De Forest Phonofilms Ltd., of Craven House, Kingsway, London, W.C. 2.*

This invention relates to means for shielding microphones and associated amplifier apparatus from disturbances due to electro-magnetic or electro-static disturbances. A and B are

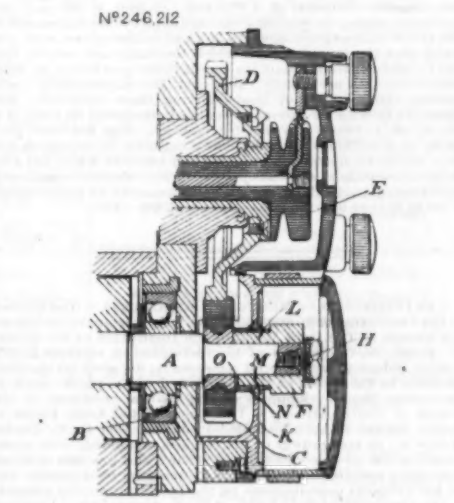


microphones of any desired type, which are enclosed in an open-mesh metallic casing C. The wires leading to the microphones are encased in metallic conduits or sheaths D. The amplifier E is enclosed in a metal casing F, the sheaths D, the open-mesh metallic casing C and the metallic casing F of the amplifier all being connected to earth at G.—*January 28th*, 1926.

MOTOR CARS AND ROAD TRAFFIC.

246,212. October 21st, 1924.—IMPROVEMENTS IN AND RELATING TO MAGNETO-ELECTRIC MACHINES, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2, Leonard Griffiths, of 16, Grafton-street, Coventry, and Cecil Morton, of 272, Foleshill-road, Coventry.

The object of this present invention is to prevent the ionised



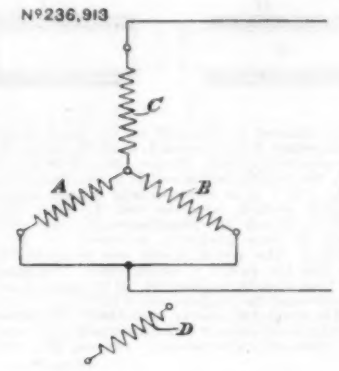
air from the distributor and also oil from reaching the contact breaker chamber, and consists in providing a sealing gland in the clearance space between the contact breaker base and stem

of the cam. A represents the rotor spindle mounted at the contact breaker end in a bearing B, and C and D indicate gear wheels connecting the spindle A and a spark gap distributor E. The rotor spindle carries a contact breaker cam F, which is adapted to be retained in position by means of a screw H. The base K of the contact breaker surrounds the stem L of the cam F, and its central aperture is sufficiently large to clear the cam when removing the contact breaker from the magneto. To prevent oil from reaching the gear wheels C and D and the products of ionisation from the distributor E reaching the contact breaker, by way of the clearance space between the base K and the stem L, a sealing gland is provided. In the form shown in the drawing it comprises a ring M, which is pressed on to the stem L of the cam and provided with a groove for the reception of a felt washer N. A distance piece O is provided between the ring M and the gear wheel C.—*January 21st*, 1926.

MISCELLANEOUS.

236,913. June 17th, 1925.—INDUCTION REGULATOR, Maschinenfabrik Oerlikon, of Oerlikon, near Zurich, Switzerland.

Single-phase induction regulators of the usual construction consist of an exciting portion, generally formed of two windings covering substantially half the pole pitch, one of which is short-circuited on itself and used as a compensating winding, whilst the other serves as an exciting winding. It is often stipulated that the same regulator should also be capable of operating as a three-phase current induction regulator. This requirement has been fulfilled by forming the winding of the exciting portion as a normal three-phase current winding with an external neutral point. When operating with single-phase current, two phases connected in series are employed as the exciting winding;



whilst the other phase, short-circuited through the neutral point, is used as compensating winding. This method of operation is not, however, satisfactory, and the object of this invention is to overcome the disadvantages of a regulator of this kind. In the drawing the phases indicated by A and B are short-circuited, as shown, whilst the network is connected to the third phase C and to the short-circuit connection of the phases A and B. The winding indicated by D is that of the stationary part of the induction regulator, and may be a single-phase winding or a three-phase winding, according to whether the regulator is used for single phase or for single phase and three-phase current. In the latter case, two of the three phases are connected in series and form the winding for single-phase operation.—*January 28th*, 1926.

246,406. September 17th, 1925.—PROCESS FOR THE MANUFACTURE OF VERY FINE TUNGSTEN WIRES, IN PARTICULAR FOR ELECTRIC INCANDESCENT LAMPS, *The General Electric Company, Ltd., of Magnet House, Kingsway, London, W.C.* 2.

The new process described in this specification is employed with especial advantage for the preparation of tungsten filaments for miniature electric incandescent lamps. The process may be carried out, for example, as follows:—Thoriated tungstem wire of 0·014 mm. diameter, bent into circular form, is fused in a known manner into the glass "pinches" of a number of miniature incandescent lamps. The total length of the filament depends on the voltage, and varies from 4 mm. to 6 mm. A bath of fusion mixture, preferably of equal parts of sodium nitrite and sodium nitrate, at 340 deg. Cent., is used as the etching agent. The "pinches" carrying the tungsten wires are dipped into this bath and held there for a space of three-quarters of a minute, if the diameter of the wire is to be reduced to 0·007 mm. If the "pinches" with the tungsten wires be kept in the bath a minute the diameter is reduced to 0·005 mm., *i.e.*, to about one-third the original diameter. After etching, the "pinches" are washed thoroughly, dried and sealed into bulbs, and the lamps are then exhausted and capped in a known manner. It is preferable to fuse un-etched wires in the "pinches" owing to the extreme difficulty of sealing a wire of diameter less than 0·01 mm. securely into the pinch. By using these fine tungsten filaments of 0·007 mm., or even 0·005 mm., in miniature lamps, the current consumption is reduced from about 200 to 300 milliampères down to 20 to 40 milliampères, with the result that the batteries from which the lamps are usually run last for about twenty hours instead of three-quarters of an hour or one hour, as previously. Moreover, the substantially lower current consumption of lamps having these extremely fine filaments enables considerably smaller batteries to be used, if a life of one to two hours only be required. Fine filaments prepared in accordance with the invention may be employed not only in electric incandescent lamps and vacuum tubes, but also very successfully as suspension wires in very sensitive measuring instruments, particularly in torsion instruments, as well as cross-wires in optical instruments.—*January 28th*, 1926.

THE INSTITUTION OF MINING AND METALLURGY.—The Council of the Institution of Mining and Metallurgy has made the following awards:—The Gold Medal of the Institution to Sir Robert N. Kotzé, in recognition of his distinguished services to the mining industry, with special reference to his work on the dust problem in the mines of the Rand, and of his public work in promoting the development of the natural resources of the Union of South Africa; "The Consolidated Gold Fields of South Africa, Ltd.," Gold Medal to Professor L. H. Cooke, A.R.S.M., in recognition of his services, extending over many years, in the advancement of the science and practice of mine-surveying and the improvement of surveying instruments, and of his valuable contributions to the literature on the subject; "The Consolidated Gold Fields of South Africa, Ltd.," Premium of forty guineas to Dr. H. C. Boydell for his paper on "The *Rôle* of Colloidal Solutions in the Formation of Mineral Deposits." Sir Robert Kotzé occupies the position of Government Mining Engineer for the Union of South Africa.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTE OF METALS: SWANSEA LOCAL SECTION.—Metallurgical Department, University College, Singleton Park, Swansea. Discussion on "Annealing." 7.15 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, Westminster, London, S.W. 1. Informal meeting. Kinematograph Exhibition, showing the manufacture of a 50,000-kilowatt turbine and generator, the distillation of motor spirit and other subjects of engineering interest. 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Lecturette, "Paint Spraying," by Mr. F. E. Webb. 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Literary and Philosophical Society's Rooms, Newcastle-upon-Tyne. Paper, "What is Sea Speed?" by Mr. R. J. Eyres. 7.30 p.m.

RAILWAY CLUB.—65, Belgrave-road, London, S.W. 1. Paper, "The Early History of the Great Northern Railway," by Mr. W. N. R. J. Back. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Discourse, "Radiation from Electric Discharges," by Sir J. J. Thomson. 9 p.m.

STUDENTS' ANNUAL JOINT MEETING OF THE LOCAL BRANCHES OF THE INSTITUTIONS OF CIVIL, MECHANICAL AND ELECTRICAL ENGINEERS.—Grand Hotel, Birmingham. Discussion on "The Design and Equipment of a Modern Factory." 7.30 p.m.

WEST OF SCOTLAND IRON AND STEEL INSTITUTE.—Room 24, Royal Technical College, Glasgow. Paper, "Corrosion: Practical Problems in the Light of Present Theories," by Mr. J. Mitchell. 7 p.m.

SATURDAY, MARCH 13TH.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS: LONDON BRANCH.—Visit to Chislet Colliery, near Canterbury.

INSTITUTION OF CIVIL ENGINEERS.—Students' visit to the reconstruction works at the Bank of England.

JUNIOR INSTITUTION OF ENGINEERS.—Visit to the workshops and wharf of the Corporation of Trinity House at Blackwall. 2.15 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. "The Rare Gases of the Atmosphere—II.," by Sir E. Rutherford. 3 p.m.

MONDAY, MARCH 15TH.

BRADFORD ENGINEERING SOCIETY.—Technical College, Great Horton-road, Bradford. Lecture, "The Production and Modern Applications of Dissolved Acetylene," by Mr. W. C. Freeman. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The College, Loughborough. Loughborough Graduates' meeting. Paper, "Variable Gears," by Mr. Baker. 7 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS: SCOTTISH CENTRE.—Royal Technical College, Glasgow. Paper, "Automobile Gears," by Mr. H. E. Merritt. 7.30 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. Cantor Lecture, "Thermometry, I.," by Mr. W. F. Higgins. 8 p.m.

TUESDAY, MARCH 16TH.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—Applied Science Department of the University, St. George's-square, Sheffield. Paper, "Aluminium: Where and how it is Made," by Mr. G. B. Brook. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Broadgate Café, Coventry. Coventry Graduates' meeting. Paper, "Automobile Rear Axles," by Mr. R. Seale. 7.15 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS: WOLVERHAMPTON CENTRE.—Engineering and Scientific Club, Queen-street, Wolverhampton. Paper, "Electric Ignition Equipment," by Captain A. C. Burgoine. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Lecture, "The Growth of Crystals, I.," by Professor C. H. Desch. 5.15 p.m.

WEDNESDAY, MARCH 17TH.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Chamber of Commerce, New-street, Birmingham. Birmingham Graduates' meeting. Paper, "Some Problems we Meet," by Mr. L. H. Dawtrey. 7.30 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, London, S.W. 1. Students' meeting. Paper, "The Production of Gaseous Fuel," by Mr. J. G. Kimber. 6 p.m.

INSTITUTION OF STRUCTURAL ENGINEERS.—Denison House, 296, Vauxhall Bridge-road, London, S.W. 1. Joint meeting with the British Section of the Society of Civil Engineers of France. Paper, "Notes on the Restoration of the Palace of Versailles and the Trianon," by Mr. A. Knappen. 8 p.m.

MANCHESTER METALLURGICAL SOCIETY.—College of Technology, Manchester. Paper, "Steel Castings," by Mr. G. E. Wells. 7 p.m.

ROYAL METEOROLOGICAL SOCIETY.—49, Cromwell-road, South Kensington, London, S.W. 7. Lecture, "Some Recent Advances in Atmospheric Physics," by Dr. Sydney Chapman. 7.30 p.m.

THURSDAY, MARCH 18TH.

INSTITUTE OF METALS: LONDON LOCAL SECTION.—Institute of Marine Engineers, 85–88, The Minories, London, E. 1. Paper, "The Preparation and Structure of Wires of Pure Tungsten," by Dr. C. J. Smithells. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Watergate House, Adelphi, London, W.C. 2. Paper, "Electric Lighting and Starting," by Messrs. C. W. Mallett and S. T. Henn. 7.30 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, London, W.C. 2. Paper, "Developments in High-power Fusible Cut-outs," by Mr. L. C. Grant. 6 p.m.

FRIDAY, MARCH 19TH.

INSTITUTION OF ENGINEERING INSPECTION.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "Lubricating and Allied Oils," by Mr. E. A. Evans. 7.30 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate Westminster, London, S.W. 1. Paper, "The High-efficiency Oil Engine," by Mr. A. E. L. Chorlton. 6 p.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Victoria Hotel, Deansgate, Manchester. North-Western District meeting. Address on "New Legislation Affecting Local Authorities, including the Public Health Act, 1925, and the Roads Improvement Act, 1925," by Sir Lewis Beard. 2.30 p.m.

INSTITUTION OF STRUCTURAL ENGINEERS: YORKSHIRE BRANCH.—Great Northern Hotel, Leeds. Paper, "Some Preliminary Factors Affecting the Design of Industrial Buildings," by Mr. C. A. Harding. 6.30 p.m.

INSTITUTION OF STRUCTURAL ENGINEERS: IRISH BRANCH.—Physics Lecture Theatre, University College, Earlsfort-terrace, Dublin. Paper, "Regulations for Steel-framed Buildings," by Mr. E. S. Andrews. 8 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Paper, "Pipe Work: Its Manufacture and Lay-out," by Mr. G. H. Willett. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Discourse, "Chips from a Sculptor's Notebook," by Mr. John Tweed. 9 p.m.

WEST BROMWICH ENGINEERING SOCIETY.—Technical School, West Bromwich. Radio Section meeting. Paper, "Radio Distortion," by Mr. J. A. Cooper. 7.30 p.m.

SATURDAY, MARCH 20TH.

JUNIOR INSTITUTION OF ENGINEERS.—Visit to the Barking power station of the County of London Electric Supply Company, Ltd. 2.15 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. "The Rare Gases of the Atmosphere, III.," by Sir Ernest Rutherford. 3 p.m.

WEST BROMWICH ENGINEERING SOCIETY.—Sandwell Hotel, West Bromwich. Annual dinner. 6.30 p.m.

TUESDAY, MARCH 23RD.

INSTITUTE OF MARINE ENGINEERS.—85–88, The Minories, Tower Hill, London, E. 1. "Super-pressure Steam Generation," by Mr. D. Brownlie. 6.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Society of Motor Manufacturers and Traders, 83, Pall Mall, London, S.W. 1. Paper, "The Main Free Vibrations of an Autocar," by Professor J. J. Guest. 7 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: NORTH MIDLAND CENTRE.—Yorkshire Cinema Exchange, Queen's Arcade, Leeds. Paper, "Some Notes on the Installation of a Modern Power Unit," by Mr. J. W. J. Townley. 7 p.m.

WEDNESDAY, MARCH 24TH.

INSTITUTION OF AUTOMOBILE ENGINEERS: NORTH OF ENGLAND CENTRE.—Milton Hall, Deansgate, Manchester. Paper, "The Metallurgist in Inspection and Design," by Mr. W. Topliss. 7.15 p.m.

FRIDAY, MARCH 26TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, Westminster, London, S.W. 1. Informal meeting. Discussion on "Foundry Practice, with Special Relation to Perlit Iron," introduced by Mr. Summers Hunter. 7 p.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—92, Victoria-street, London, S.W. 1. Metropolitan District meeting. Paper, "The Life of Wood Paving as Affected by Expansion," by Mr. J. Garvie. 6.30 p.m.

MANCHESTER ASSOCIATION OF ENGINEERS.—Engineers' Club, Manchester. Paper, "Hydro-electric Engineering," by Mr. P. W. Seemer. 7.15 p.m.

SATURDAY, MARCH 27TH.

INSTITUTE OF MARINE ENGINEERS.—85–88, The Minories, Tower Hill, London, E. 1. Juniors' social and dance. 7 p.m.

EXHIBITION OF LIGHTING APPLIANCES.—We are informed by the secretary of the Institution of Public Lighting Engineers that in connection with its third annual meeting and conference of that body, to be held at Newcastle-upon-Tyne, it is proposed to hold an exhibition of up-to-date lighting appliances, both gas and electric. The exhibition will be opened by the Lord Mayor of Newcastle, and will remain open during the three days of the conference, viz., September 14th, 15th and 16th. It is requested that firms desirous of exhibiting should apply to Mr. R. Davison, President-elect, public lighting superintendent, Corporation Lighting Department, Blagdon-street, Newcastle-upon-Tyne.

STANDARD MARINE ENGINE TESTS.—The Marine Committee of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, London, S.W. 1, has drawn up a standard form of marine engine test report, also standard test conditions which may be applied for the uniform testing of petrol, petrol-paraffin, and hot bulb marine engines of 10 brake horse-power output and upwards. The conditions include the following:—(1) Full horse-power test of engine and reverse gear in ahead position at rated brake horse-power and speed specified for four hours; (2) one-hour no-load test at not more than two-thirds speed, without fuel adjustment, then open throttle; (3) the power during the tests to be absorbed by a brake of positive type, devoid of any efficiency factor; (4) fuel and lubricating oil consumption to be within any figure guaranteed; (5) momentary and steady governing to be within any guaranteed percentage; (6) half an hour astern with throttle fully opened to test reverse gear at the revolutions obtained, and under the same conditions of engine adjustment, as for test No. 1, but no brake horse-power reading to be taken; (7) petrol-paraffin engines to be restarted on paraffin not less than half an hour after being stopped, no petrol to be used; (8) sample of fuel used at trials to be submitted for customers' analysis, and to agree with that specified, if any; (9) dimensions of engines and reverse gears throughout to comply with Lloyds' rules or to a specification approved by Lloyds.

COAL-CUTTING MACHINERY.—At a meeting of the Junior Institution of Engineers, held on February 19th, Mr. S. Reilly, Assoc. Member, delivered a lecture on the subject of "Coal-cutting Machinery." He began with a general description of the coal face and the method of machine mining, and showed by means of slides the "long-wall" and "heading" methods of working. Disc, bar and chain machines were fully described and illustrated, and many facts and figures concerning their operation were given. It was explained that in Scottish mines the long-wall method of working had to be used on account of the small depths of the seams of coal, which varied between 9in. and 14in. The height between the roof and pavement was therefore never much more than 2ft. 6in., and in this space the coal-cutting machines had to work. It would be impossible to work these seams with hand picks. A modern electric disc coal cutter weighed about 2¼ tons and had a motor of about 30 horse-power. The disc ran at anything from 10 to 30 revolutions per minute. Forced lubrication was used. The machine was totally enclosed so as to be flame-proof, although it was not necessarily gas-proof. Under the arduous conditions of working it was impossible to keep all joints absolutely tight. The cost of maintaining a machine was about 1·2d. per ton of coal worked, and the cost of power was about 2·5d. per unit. The initial cost of the machine was about £700, when installed at the coal face, and its life depended much on the way it was treated. The chief troubles were electrical, and were greatly increased by abuse of the machine. The life of an armature was usually four to five months. New machines were being made only 12in. high and were adapted for remote control.